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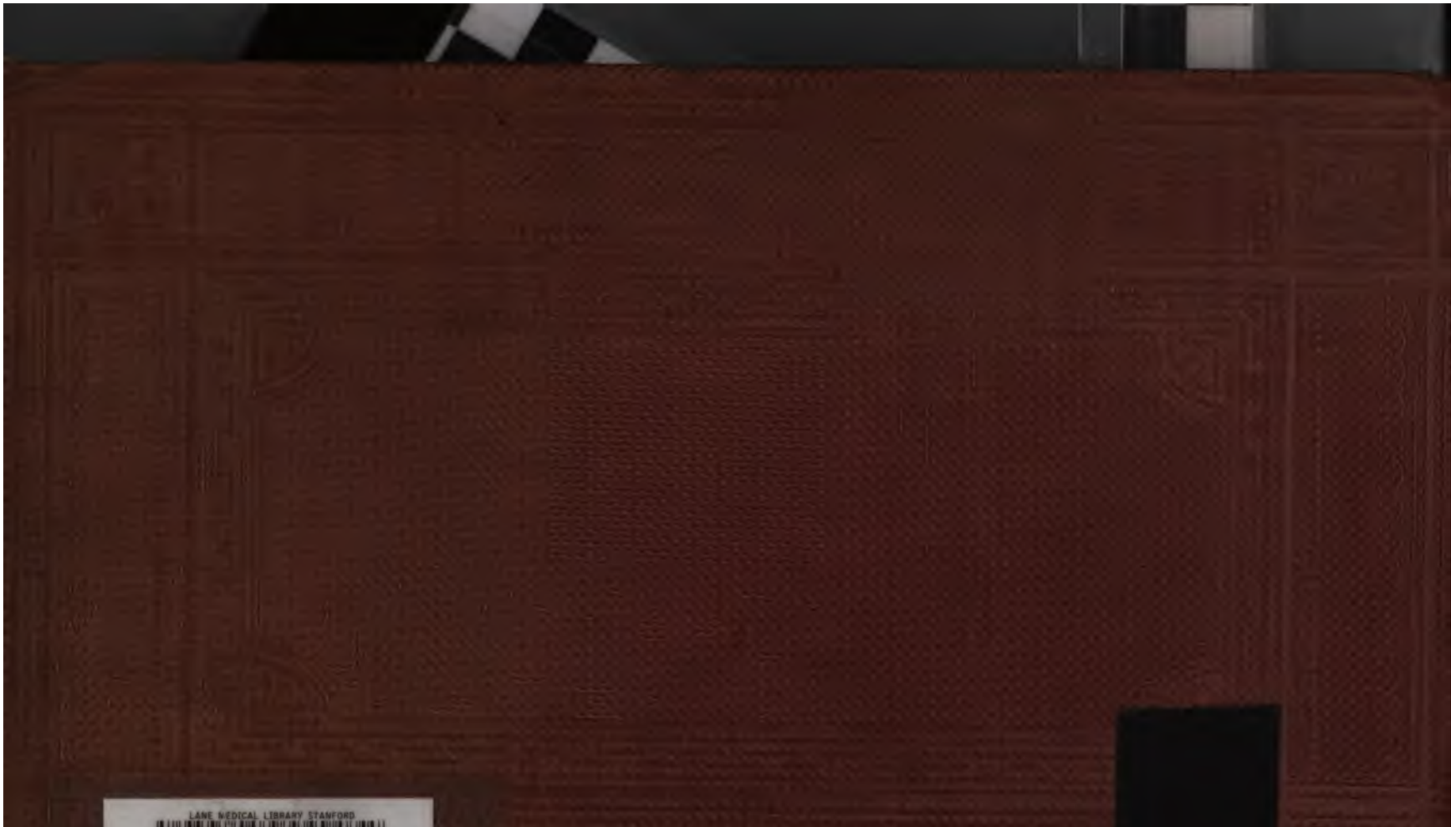
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PREFACE.

THE only apology for bringing a reprint of this work before the profession in a different form is, that in the previous one published in 1859, 'Notes on the Wounded from the Mutiny in India' (all the copies of which have been sold), and which was a collection of cases without any table of contents and headings to pages or index, and consequently difficult for perusal and reference by any one interested in any particular subject. I have now endeavoured to remedy this, and have also made a few general remarks under each head,—these are, for the most part, the result of my own observation. Still I have no doubt that there may be a difference of opinion on the various kinds of practice, by those medical officers who have had much greater experience than myself. I can, however, only trust that the remarks I have made may be of some use to the medical officers of the army.

In the Preface to the 'Notes on the Wounded from the Mutiny in India,' the following paragraphs appear:—

"All Soldiers of Cavalry and Infantry of the Line, invalided on account of wounds, pass through the Invalid Depôt at Chatham.

"It is there, then, that probably the best opportunity is to

be found for ascertaining the results of different wars, in the several classes and species of wounds, and in the proportion which those classes and species bear to each other, and to the total by all wounds. The collection and record of such results seem to me to be always very desirable; and I have availed myself of the opportunity alluded to as regards the wounded by the mutiny in India. The following pages contain the result of my labours. I feel that they might have been made more valuable and interesting had similar accurate records existed of the invalids wounded by former wars, with which I could have compared data, and so have drawn more comprehensive information, statistical and surgical. I am in hopes, however, that some points worthy of notice have been elicited; and, for example, I may refer to the large number of gunshot compound fracture of the femur, where the patients have recovered with good, useful limbs, as compared with the number of thigh-stump cases, and the total by all wounds.

"This very satisfactory feature in the classified return of invalided wounded by the mutiny, appears to me perhaps not uncommon for Indian wars, but certainly very much so for European wars, as far as records enable me to make the comparison. This difference in favour of results by Indian wars I believe to be mainly due to the facilities afforded by the dooley for the successful treatment of this severest of all forms of compound fracture. Eleven cases recovered, with good, useful limbs, out of the total wounded landed from India—viz., 842. This is a large proportion compared with the result of the Crimean war, viz., 8 out of 2296."

Medical officers who have served in India are, I believe, unanimous in opinion, that there is no means of transit for

sick and wounded equal to the dooley; and should this be admitted by the public and the Government, there seems no reason why our Indian subjects should not furnish us with a supply of doolies and bearers in all our wars out of India. That such a means of transport would be expensive, must be admitted; but probably not so very much more expensive than the means usually supplied. The difference would not, I believe, be grudged by the public, who would find their satisfaction in the more favorable results amongst the severer classes of cases of invalided wounded arriving at the depot.

Advantage has been taken of the valuable preparations on this subject contained in the Museum of the Army Medical Department, to illustrate these notes. Every preparation of gunshot wound contained in the Museum has been detailed in the following pages up to 1859. The specimens have been carefully described, and the history of the cases detailed as fully as possible, and several lithographic drawings have also been inserted. This, it is hoped, may be of some use, as informing the profession of what preparations of gunshot and other injuries received in action the Museum at Netley contains.

G. WILLIAMSON.

GOSPORT;
December, 1863.

PROPERTY OF THE

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INTRODUCTION.

In the present day Military Surgery may be looked upon as a subdivision of the medical profession, subject to the various circumstances in which soldiers are placed, both in home and foreign quarters or in the field.

Soldiers are exposed to more numerous sources of disease, in consequence of the frequent and sudden changes of climate, than the civil part of the population; the rules of practice, therefore, which would guide a surgeon in civil, are quite inapplicable to those in military life.

In civil life the cure of disease is the chief matter to be considered; whereas, in the army, it is the prevention of diseases amongst a number of men in the prime of life and of sound constitution, and that the surgeon who has the lowest sick list (and *no convalescents*) and the greatest number of effective soldiers, may be looked upon as to have best performed his duties as an army medical officer. Hygiene in its application to the army is a subject of the greatest importance, and it may be said to have been originated, or at all events to have been greatly advanced, by military and naval medical men.

At the beginning of this century assistant-surgeons were only warrant officers, under the designation of "hospital mates." In 1813, assistant-surgeons were commissioned by the king; but although slight improvement was made on two occasions, still little real advantages were granted to the department until the late war with Russia occurred. Previous to this the

medical officers were in a very dependent position and without any responsibility; consequently, on the outbreak of this war, when great sickness occurred, the medical officers were at first much blamed; but after several commissions had assembled, the medical officers were exonerated from any neglect or want of precaution on their own parts, and everything was to be attributed to their want of responsibility and depending entirely on other departments.

A Royal Commission was ordered, which recommended in a warrant, dated 1st October, 1858, a complete re-organization of the Army Medical Department in all its branches, and with the establishment of an Army Medical School, for the instruction of candidates for the department. This had for many years been advocated by all the greatest writers on military subjects since 1798, when Mr. John Bell first brought it under the notice of Government.

Lord Herbert, to whom it may be said that a great number of the improvements in the Army Medical Department are chiefly due, stated, on the opening of the Medical School at Fort Pitt, on the 2nd October, 1860, "that the objects contemplated by Government in establishing this school, were not only to give an acquaintance with the specialities of military medical life, but especially to teach the most approved methods of preventing disease."

At Fort Pitt formerly, and now at Netley, there have always been great opportunities of studying, diagnosing, and treating tropical diseases and those peculiar to soldiers; and this knowledge could never be acquired in civil schools.

Lord Herbert, on the same occasion, said further:—"The Military Medical School which had now been instituted, resulted from this Commission; and while he was thus responsible for its origin, accidental circumstances had now made him officially responsible for its organization. The objects contemplated by the Government in establishing this school, were not only to give an acquaintance with the specialities of military medical life, but especially to teach the most approved methods of preventing disease. In this respect it was anticipated that this school ought to produce great benefit. There was no opportunity of learning elsewhere much that would be

taught in it. The treatment of tropical diseases, and of diseases peculiar to soldiers, cannot be acquired in the civil schools. The position of the army medical officer, too, differed from that of his brother in civil life, especially in this, that the attention of the latter was, for the most part, taken up in curing disease, while he had very little opportunity of preventing it. Indeed, it seems almost against his interests to prevent disease. It was only the sick person who sent for the doctor, not the man that was well; and with the exception of the naval and military medical officers, it might, perhaps, be said that there were no medical men who could gain a livelihood, not by curing, but by preventing sickness.

"He would especially say a few words to those who had just arrived to study at this school. He was aware their position was a novel one, and he knew that they were exposed to many sources of temptation to vice; but he hoped that, as medical officers, they would do their utmost to support the dignity of their profession. They must remember that they entered the service older in years than the young combatant officers with whom they would often associate,—whereas the combatant officers often entered the service as boys fresh from school. Besides this, the medical officer entered after having had the benefit of a scientific education, which, for the most part, the combatant officer had not had the advantage of having. He did not wish to put youth forward as a plea of justification for vice; but youth affecting manhood finds it easier to ape the vices of men than to emulate their virtues. Medical officers ought not merely to avoid such errors, but ought by their example and conduct to divert the tendency of their younger companions into a more useful sphere of action.

"The relationship between the military and the medical element of the army had also of late years greatly changed. Commanding officers now felt the importance of having medical officers who could preserve the health of the men under their command.

"He knew of a case where a medical officer went to the military officer in command and told him that unless such and such things were done, there would soon be a dreadful sickness among the men. The reply was: 'When your advice is

wanted, it will be asked for.' Accordingly, nothing was done, but when the men were down with sickness, as had been predicted, then the doctor was sent for, but it was too late. Now it is very different. He had just been reading a letter from the Adjutant-General with the army in China. It conveyed the most gratifying accounts of the present excellent condition, as to health, of the China force, and it showed how much benefit had arisen from the appointment of a Sanitary Inspector. This was the first time such an appointment had been made. It was one of the new regulations, and was the result of the recommendation of the Royal Commission.

"He believed that no men now were more anxious to enforce and carry out sanitary measures for those under their command than the military officers. It had been anticipated that such would be the result.

"Great advantages were now enjoyed by medical officers over their predecessors. Their position, especially in the earlier part of their career, had been greatly improved by the new warrant. Their rank, pay, and influence had all been augmented. The country would now naturally look for some return for these advantages, and he trusted the gentlemen now present would endeavour, on their part, to profit to the greatest extent by the advantages the Government have afforded them in the establishment of this school. If they showed, by their increased intelligence and zeal, that they were worthy of these advantages, the country would not grudge the cost, but they would be expected to prove their superiority to justify the outlay, and he felt certain that they would do so. He concluded by wishing them every success and happiness in their new career."

The Director-General of the Army Medical Department said, that, as the head of the department to which the candidates belonged, he, too, would say a few words on this important occasion. "He hoped especially that they would profit from the remarks of the Right Honorable the Secretary for War, to whom the institution of this school was mainly owing. He trusted, also, that they would continue to give satisfaction to the General who commanded them, and to the Principal Medical Officer of the station. He observed that, after the

gentlemen had completed their period of probation here, they would have to undergo examinations on the topics they had been specially studying. No one would receive a commission who did not acquit himself creditably, or who did not give satisfactory evidence of being qualified for the practical duties of an army medical officer. On the other hand, those who did pay the most attention to the subjects taught, and who were found at the examinations to have profited most by their studies—to them he intended to give the first and the best appointments. They should be sent to the most popular stations or to the regiments which were considered the best, as far as the exigencies of the service would allow."

The Medical School at Netley must be looked upon by the profession generally, and especially by the Army Medical Department, as a grand institution for the education of medical men for the special duties of Army Surgeons; for it is well known that however high the attainments of a medical man are for practice either as a surgeon or physician in civil life, he would find in the army that he had still a great deal to learn, and at first he would be very much out of his proper sphere.

Every medical candidate for the army should be especially well grounded in anatomy and surgery, as without the thorough knowledge of the former, and also of the practice of the latter, he will often find himself very awkwardly situated, however well he may be educated as a physician. It is also necessary that he should have an accurate information with regard to the habits of the soldier, his manner of life, duties, &c., and this more particularly during a campaign.

It is especially necessary that all medical officers on entering the service should have an opportunity of seeing invalids from all our colonies, but particularly those from India and other tropical climates, as their diseases are a special study.

The results of tropical diseases, as revealed on post-mortem examinations, can also be well studied at the General Hospital at Netley, and also by the aid of the valuable Pathological Museum, collected by the medical officers from all parts of the world.

In 1810, Sir James M'Gregor, at that time Inspector of

Hospitals, then stationed at Portsmouth, originated and strongly advocated the collection of specimens of morbid anatomy, for the use of the medical officers of the army. In 1816, Sir James M'Gregor, now Director-General, made great efforts to promote this very desirable object. Still little was done until the conclusion of the Peninsular war, when the small number of preparations then in existence were transferred from the York Hospital at Chelsea to Chatham. Ever since, under the fostering care of Sir James M'Gregor, Bart., and the subsequent Director-Generals, the collection has quietly and gradually increased by the persevering energy of the medical officers; and the Museum may now be looked upon as the only one of the kind to be found in any country, and is not only of the greatest interest to the military surgeon, but also to the profession generally. It differs in every respect from any other collection in this country on account of the greater number of the preparations having been procured from patients who had served in all the various colonies where British troops were quartered. There are also detailed histories of the greater number of the specimens preserved in the MS. catalogues.

The whole of the pathological preparations were arranged by me, and a catalogue printed in 1845, by order of Government, and dedicated to the Right Honorable Sidney Herbert, M.P., Secretary for War, by the medical officers of the army. Preface: "This Catalogue (of which one copy was sent to every regiment and medical officer in the service) was intended to communicate to the officers of the department, in as few words as possible, the natures and numbers of the preparations in the collection, which has been effected principally by their zeal, and thus to enable them to understand what yet requires to be supplied by their exertions." Several fasciculi of plates in elephant folio have been published from time to time to illustrate the contents of the Museum, the last number of which was published under my superintendence in 1850, nine years after the preceding one.

During a campaign or action, the number and class of wounds and injuries are very different from what is seen in civil life, and also the mode of treatment, which has, in many instances, to be conducted according to circumstances, but espe-

cially with regard to the conveyance at the disposal of the surgeon in every particular emergency.

Surgeons in the field also often regret that they have not the opportunity of seeing the result of their practice, as patients several months after amputation or some conservative measure present a very different appearance to what they did immediately after the operations. This is always well exemplified in the men arriving at the Invalid Depôt after a campaign.

Since the warrant of the 1st October, 1858, the Army Medical Department has been very much improved in standing and pecuniary emoluments; and no doubt any grievances which the Department may have, will be rectified by the Director-General, J. B. Gibson, C.B., with the sanction of His Royal Highness the Duke of Cambridge, Commander-in-Chief, and that of the Right Hon. the Secretary of State for War.

Of the fatal cases since landing in England, 1 was a case of gunshot wound of the head,—cause of death, chronic hepatitis and ascites; 2 were cases of perforating gunshot wound of the lung,—1 of which died of gangrene of the opposite lung, and 1 of phthisis; 1 case of partial fracture of the humerus,—cause of death, pyemia; 1 case of comminuted fracture of the femur, ball lodged between the ends of the united fracture,—cause of death, chronic dysentery; 1 case of amputation of the arm,—death from gangrene of the stump; 1 case of amputation at the middle of the thigh,—cause of death, necrosis and exhaustion. Besides these, 1 (an artilleryman) died at Gravesend, from gunshot fracture of the tibia, followed by sloughing, but not included in the return.

Descriptive Numerical Return of Wounds and Injuries received in action during the Mutiny in India, and the sufferers from which were landed in England at Fort Pitt, to the 30th June, 1859.

Classification and Specification of Wounds and Injuries.	Landed at Gravesend.	Discharged to duty.	Discharged to modified duty.	Invalided.	Died.	Remaining indisposed.
1. Gunshot Wounds of the Head:—						
1. Contusion and simple flesh wounds of the scalp	3	3	—	—	—	—
2. With contusion or fracture of the cranium, without depression	11	6	—	5	—	—
3. Ditto, with depression, or displacement of both tables	11	2	1	7	1	—
Total	25	11	1	12	1	—
2. Gunshot Wounds of the Face:—						
1. Simple flesh contusions and wounds	1	—	—	1	—	—
2. Penetrating, perforating, or lacerating the bony structures, without lesion of important organs	6	4	—	2	—	—
3. Ditto, with lesion of the eye	12	3	—	9	—	—
4. Ditto, with fracture of the lower jaw	8	2	1	5	—	—
Total	27	9	1	17	—	—

Classification and Specification of Wounds and Injuries.	Landed at Gravesend.	Discharged to duty.	Discharged to modified duty	Invalided.	Died.	Remaining unreported.
3. Gunshot Wounds of the Neck:—						
1. Simple flesh contusions and wounds	8	8	—	—	—	..
4. Gunshot Wounds of the Chest:—						
1. Simple flesh contusions and wounds	7	7	—	-	--	--
2. With injury of bony or cartilaginous parietes, without lesion of contents	8	5	1	2	—	—
3. With lesion of contents by contusion, or with non-penetrating wound ...	3	2	—	1	—	--
4. Perforating contents	12	6	2	2	2	
Total	30	20	3	5	2	—
5. Gunshot Wounds of the Abdomen:—						
1. Simple flesh contusions and wounds	4	4	—	—	-	
2. Contusion, or non-penetrating wound, with lesion of stomach..... ..	2	2	—	—	..	..
3. Penetrating or perforating, with lesion of intestine	2	—	—	2	—	--
Total	8	6	--	2	..	
6. Gunshot Wounds of Back and Spine:—						
1. Simple flesh contusions and wounds	4	4	—	.	—	—
2. With fracture of vertebræ, without lesion of spinal cord.....	6	2	—	4	--	--
Total	10	6	—	4	—	—
7. Gunshot Contusions and Wounds of the Perineum and Genital and Urinary Organs, not being at the same time Wounds of the Peritoneum	4	2	—	2	.	..
8. Gunshot Wounds of the Upper Extremities:—						
1. Simple flesh contusion and wounds (slight)	51	39	9	11	—	—
„ „ (severe)	8	—	—	—	—	—
2. With contusion and partial fracture of long bones, including fracture of the clavicle and scapula	50	19	8	22	1	—
3. Simple fracture of long bones by contusion from round shot	3	1	—	2	—	—
4. With compound fracture of humerus	23	—	6	17	--	—
„ „ radius...	19	1	2	16	—	—
„ „ ulna ...	9	4	1	4	—	—
With compound fracture of ulna and radius	3	1	—	2	—	—
5. Penetrating, perforating, or lacerating the several structures of the carpus and metacarpus	33	6	9	18	—	—
6. Dividing or lacerating the structures of the fingers and thumbs	13	5	—	8	—	—
Total	212	76	35	100	1	—

Classification and Specification of Wounds and Injuries.	Landed at Gravesend.	Discharged to duty.	Discharged to modified duty.	Invalided.	Died.	Remaining indisposed.
9. Gunshot Wounds of the Lower Extremities:—						
1. Simple flesh contusions and wounds (slight)	117	—	—	—	—	—
" " (severe)	13	90	15	25	—	—
2. With contusion and partial fracture of long bones, or of the bones of the pelvis, in their relation to the lower extremities	50	29	6	15	—	—
3. With simple fracture of long bones by contusion of round shot	3	—	1	2	—	—
4. With compound fracture of femur	13	—	3	9	1	—
" " tibia only	11	—	2	8	1	—
" " fibula only	4	3	—	1	—	—
" " tibia and fibula	2	—	—	2	—	—
5. Penetrating, perforating, or lacerating the several structures of the tarsus and metatarsus	18	6	4	8	—	—
6. Dividing or lacerating the structure of the toes	3	1	1	1	—	—
Total	234	129	32	71	2	—
10. Gunshot Wounds with direct penetration or perforation of the Larger Joints, with Fracture of Bone	10	2	—	8	—	—
Ditto, without Fracture	1	—	—	1	—	—
11. Gunshot Wounds with direct Injury of the Larger Arteries, not being at the same time cases of Compound Fracture	1	—	—	1	—	—
12. Gunshot Wounds with direct Injury of Large Nerves, not being at the same time cases of Compound Fracture	9	3	2	4	—	—
13. Sword and Lance Wounds	47	14	9	24	—	—
14. Bayonet Wounds	2	2	—	—	—	—
15. Miscellaneous Wounds	16	8	4	4	—	—

Description of Operation.	Landed at Gravesend.	Discharged to duty.	Discharged to modified duty.	Invalided.	Died.	Remaining indisposed.
16. AMPUTATIONS.						
Upper Extremities:—						
Shoulder-joint	8	—	—	8	—	—
Arm	52	—	3	48	1	—
Forearm	22	—	2	20	—	—
Thumbs	16	2	6	8	—	—
Fingers	54	5	17	32	—	—
Total	152	7	28	116	1	—
Lower Extremities:—						
Thigh, at upper third	1	—	—	1	—	—
„ middle third	14	—	—	13	1	—
Leg	21	—	—	21	—	—
Ankle-joint	1	—	—	1	—	—
Metatarsus	3	—	—	3	—	—
Toes	3	1	1	1	—	—
Total	195	8	29	156	2	—
17. EXCISIONS.						
Upper Extremities:—						
Shoulder-joint	1	—	1	—	—	—
Elbow-joint	2	—	2	—	—	—
Total	3	—	3	—	—	—
GRAND TOTAL	842	302	119	413	8	—

This Descriptive Numerical Return has not been strictly adhered to in the letterpress, under Wounds of the Neck, Chest, and Abdomen, &c.; still it should be adhered to in making up Returns of Gunshot Wounds.

REMARKS

ON

MILITARY SURGERY.

CHAPTER I.

GUNSHOT WOUNDS IN GENERAL.

The difficulties that the army surgeon has to encounter after an action are very great, and require that he should have great resources within himself, on account of having so many wounded to attend at once. This is the time when knowledge, skill, and decision are displayed. The peculiarities observed in gunshot wounds were, in former times, ascribed to the parts being burnt by the ball; to their being poisoned; to the effects of electricity, &c.; they, however, can be accounted for by the bluntness of the projectile, the rapidity of its course, and the force with which it is propelled. Gunshot wounds are of the contused and lacerated kind, and present peculiarities as to colour, shape, and size of the orifice, conjoined with sloughing, which always occurs in the track of the ball; although sharp splinters of shell occasionally produce incised wounds. When the patient survives, active inflammation, deep-seated suppuration, and profuse discharge generally ensue.

The kind of projectiles which are in use in modern warfare are the pistol, musket, rifle, and cannon ball, shell, grape, and canister shot, &c. The Enfield rifle ball, hollow in the base, is

1 oz. 2 scr. 1 gr. The Minié ball used by some French regiments are 1 oz. 2 dr. 2 scr. 10 gr. The siege rifle ball used by the Russian army, with a conical flat base, three rings, and two raised ribs to fit grooves in the barrel, is 1 oz. 5 dr. 3 gr.

There are also cannon of different size and formation, made to throw either round shot, or cylindrical shot, or shell percussion, as in the Armstrong gun, &c.; there is the mortar for a vertical fire, calculated to throw shell; for the smooth-bore cannon there is the solid shot, the grape shot, and the canister shot. Bar shot are two large shots joined together with an iron bar between, and chain shot with a chain between two large shots. The shrapnel shell is a hollow sphere of iron, filled partly with gunpowder and with iron balls of small size, &c.; the common shell is an iron ball filled with powder only. The wounds inflicted by these various projectiles are, of course, very different. The rifle bullet produces a very small wound compared to those caused by large shot, but still they are often as fatal in their effects.

J. R. Taylor, C.B. and I.G., in his 'Explanatory Observations on Classification of Gunshot Wounds,' states: "It may at first appear objectionable to class together wounds by bullet, cannon, shot, and shell; but taking all classes of wounds brought in off the field, it will be found that the danger is more commonly in proportion to the part struck, than to the weight or magnitude of missiles."

A pistol charged with powder, if discharged with the muzzle resting close to the chest, has been known to be the cause of death. Wadding and pieces of cloth also occasionally produce serious injury. When a gun is loaded with small shot and fired close, it causes a severe lacerated wound, from being in a solid mass; when fired at a greater distance it scatters, and is less dangerous: still, if a single shot penetrated the eye, it will destroy vision, or, if it should penetrate the heart, it may cause instant death. Several men from India lost the sight of an eye from this cause.

A musket ball generally traverses, leaving two apertures, the one of entry and that of exit; sometimes there is only one aperture, and in this case the ball is probably lodged. Occasionally, however, the ball drops out through the aperture by which it

entered, or it may be easily extracted; at another time, a spent ball merely causes a contusion, from the oblique direction with which it strikes and glances off. The apertures are usually opposite to each other when a ball traverses, but when it strikes a rib or the cranium it sometimes is deflected and runs under the skin, and makes its appearance on the opposite side, without wounding any of the important organs contained in these cavities.

There is generally a considerable difference between the aperture of entrance and exit. The hole made by the entrance of the ball is small, circular, and depressed; that of exit is large, everted, and irregular. Occasionally, however, there is no difference to be observed between the two, and, in some cases, the aperture of entrance is even larger than that of exit. Mr. Guthrie explains this by stating that the amount of the difference in the two apertures depends upon the momentum of the ball, and also, in some measure, on the resistance met with. In perforating gunshot wounds where the ball is propelled in full force, the aperture of entrance is small and round, and even less than the ball itself. When its force is much diminished before striking, then the entrance aperture is large and ragged. When a ball perforates the muscular parts of a limb, where it meets with little resistance, there is almost no difference between the two apertures. When the velocity of the ball is diminished by coming in contact with a bone, the aperture of exit is large, torn, ragged, and its edges everted.

Cannon balls generally produce wounds of the most formidable description, either completely carrying away a limb or the fleshy parts of the arm or leg, or shattering the bones, &c. On other occasions a spent cannon ball may cause a contusion without even producing an external wound. This was formerly attributed to the wind of the ball, or to the air set in motion by the ball. On these occasions, although the skin, from its elasticity, is entire, still the muscles, vessels, and bones may be entirely disorganized and converted into pulp, or the internal organs may be ruptured without any external wound.

In general, there is very little hæmorrhage from gunshot wounds, provided none of the larger arteries are wounded.

When organs of importance, as the large cavities and joints, are wounded, the shock to the nervous system is almost always

very great, and in some cases most appalling, and is indicative of the amount of injury received; still, the amount of shock is not, in every case, a diagnostic indication of the severity of the wound, as much depends upon the constitution and nerve of the soldier. When a wound is received in a fleshy part, it may not be perceived at the moment of the excitement of a battle, and even a limb may be carried away without the man being conscious of it.

In general, after every gunshot wound there is more or less inflammation, swelling, and tension of parts. In some cases this is often very severe, followed by extensive suppuration in the track of the ball, and also in the neighbouring parts.

The sloughs are separated, from the tenth to the twentieth day, from the track of the ball, and at this period consecutive hæmorrhage is liable to occur, which may suddenly prove fatal, and is more dangerous than the primary hæmorrhage, from the difficulty of arresting it and from the patient being weakened from tedious suppuration.

Occasionally a large, round shot, or more usually a portion of shell, may lodge in the hip, without producing any very large wound or causing much deformity.

Musket balls, striking the shaft of the long bone, or even a flat bone, generally fracture and split it, to a greater or less extent, according to the force with which they are propelled, and the angle at which they strike.

Occasionally a ball is flattened and thrown off without causing fracture; sometimes it only produces an indentation, or a partial fracture, and passes out or remains lodged. The new conical ball splits and comminutes much more extensively than the old round ball, rendering the chances of saving life much less. Occasionally a ball is lodged in the cancellated structure of the head of a long bone, without causing any splinters. In the late war with Russia, the conical ball was not found to be often split on the sharp crist of the bone, but almost always splintered the bone against which it struck, although there is a case, of which the preparation is in the museum at Netley, that occurred in the 19th Regiment, where the ball was split on entering the cranium.

Treatment.—Superficial gunshot wounds require to be treated

on the ordinary principles of surgery. Immediate dressings and attentions are necessary (if this can be done) in gunshot wounds before the patients are sent to hospital.

When the head and neck are wounded, cold-water dressing and a bandage should be applied. When the chest is wounded, a bandage should be placed round the body, and the patient placed on the wounded side.

When the lateral part of the abdomen is wounded, the patient should be placed upon his side, and if it is in the centre, on his back, with his knees bent over a knapsack, and any protruding intestine cleaned and returned.

In wounds of the extremities, where no vessel or bone of importance is injured, cold-water dressing should be applied. When there is considerable venous hæmorrhage, the limb should be raised and a compress applied; a tourniquet should be applied when the bleeding is arterial. When a limb is partly smashed or torn away, a tourniquet should be applied, with the object of arresting the hæmorrhage and quieting the shaking of the limb.

The shock should be counteracted by the administration of brandy-and-water, to allay the thirst. The period of collapse varies in different cases, which also, in a great measure, determines whether immediate amputation should be resorted to, or to wait for a more favorable opportunity.

The arrest of hæmorrhage should be first attended to, and this is to be done by the application of a compress and bandage, or a tourniquet, or some other substitute that may be at hand.

All foreign bodies, viz., the ball, splinters of bone, wadding, &c., should at once be removed. Detached pieces of bone should be extracted, but not those that remain attached to the fracture; they should be left until loosened by suppuration.

The inflammation and sloughing which occur along the whole track of the ball are to be treated in the first instance with cold applications and rest; and as inflammation, tension, and suppuration take place, fomentations are to be employed, so as to hasten the separation of the slough, with free incisions in the direction of the limb, to lessen the inflammation, tension, and to favour the escape of matter; but poultices should not be resorted to any more than can be avoided; spungio-pilin is,

however, cleaner, and is a good substitute for a poultice. At this period there is always great danger of secondary hæmorrhage; a tourniquet should be loosely applied to the limb when the wound is in the vicinity of a large artery, so that it can be tightened when required, and the patient should be carefully watched. Should hæmorrhage take place, the artery must be tied at the wound, if possible, or at the most suitable place above it. Should the bleeding still continue, the limb must be amputated. Necrosis, abscesses, and sinuses often remain for years, producing serious injury to the patient's health, and, in some cases, ending fatally from pyæmia.

Balls, or a portion of shell, occasionally lodge and become encysted in the muscles or bone without producing much inconvenience. As it is impossible to know what injuries they may cause if not removed at once, every endeavour should be made on the part of the surgeon to accomplish their extraction, along with any other foreign body which may have been driven in with them, if this can be done without producing any serious mischief to some important organ or vessels, as in the case of Private Thomas Boulger, 84th Regiment, under gunshot wound of the lower extremities.

In cases where the ball remains unextracted a sinus continues, which occasionally heals and breaks out again from time to time, producing inflammation and suppuration in the sac, when encysted, or in its neighbourhood, necessitating continued attention and treatment. Patients in whom the ball is lodged complain of weakness, weight, and wandering pains in the limb, which is easily affected by change of weather.

Balls, and especially the old round ball, occasionally take very extraordinary courses, according to the angle at which they strike the structure, whether it is bone, tendon, or aponeurosis, and also upon the position of the body at the time.

The extraction of balls and other foreign bodies lodged is, in general, accomplished without much difficulty, if done before inflammation and swelling have come on, and if attention is paid to placing the patient in the same position as he was when injured, and putting the same muscles into action, and questioning the patient as to his ideas and feeling as to where the ball

is situated; examining the clothes as to whether any part has been carried in, as the ball may only have gone a short distance, and then dropped out under the clothes. Two apertures on opposite sides of the limb cannot be taken as decisive evidence of the ball having perforated, as they may be caused by two separate balls; occasionally, also, one ball makes several apertures.

The different kinds of forceps which have been invented for the extraction of bullets are innumerable, but it appears to me that the simplest are the best—viz., the common lever, with finger acting as probe and director, and the common dressing or polypus forceps. There are also some other more complicated instruments, which are, in some difficult cases, of great service, such as Coxeter's or Read's forceps.

Patients, soon after being wounded, seldom object to the extraction of the bullet, however reluctant they may be after months or years of a state of things of which they have become accustomed to, with all the attendant evils, such as pains, gleety discharges, &c.; still, when they have been persuaded to have the ball extracted, they express themselves as very much delighted.

CHAPTER II.

GUNSHOT WOUNDS OF THE HEAD.

Wounds of the substance of the brain, and also those of the cranium and scalp, are of a most serious character, and require very great attention and skill on the part of a surgeon engaged in civil practice, but more especially that of a military surgeon.

After an action wounds of the head do not form the greatest proportion of the cases, as very many of them are killed instantly, or die before they can receive medical assistance. Wounds of the head are much more frequent when soldiers are employed in trenches during a siege, or in cavalry engagements, than in action amongst infantry.

These injuries may be divided into—

I. *Gunshot Injuries producing Concussion or Compression with Contusion or Fracture of the Cranium without depression, and with or without any Scalp Wound.*

Concussion.
Compression.
Suppuration.
Necrosis.
Extravasation.
Fracture without depression; also Fissure, or counter-fracture.
Fracture of the external table only.
Fracture of the inner or vitreous table only.

II. *With Contusion or Fracture of the Cranium, with depression or displacement of both tables.*

III. *Penetrating or Perforating the Cranium and its contents.*

IV. *Sabre and Bayonet Wounds.*

Simple incised, punctured, or lacerated wounds of the scalp, caused by sabre cut or by the bayonet, but without Fracture of the Skull.

Simple incised, punctured, or lacerated wounds, caused by sabre or bayonet, and with Fracture of the Cranium.

V. *Circumstances under which the trephine should be employed.*

VI. *Operation of Trephining.*

VII. *Hernia Cerebri.*

VIII. *Abscesses of the Liver consequent on Gunshot Wounds of the Head.*

IX. *Treatment of Gunshot Injuries of the Head.*

I. Gunshot Injuries producing Concussion or Compression with Contusion or Fracture of the Cranium, and with or without any Scalp Wound.

Concussion.

The brain is occasionally merely temporarily disturbed in its function by external injuries, without any appreciable lesion to its structure. Its function is at first impaired, and is ultimately restored, more or less completely, should it escape inflammation of the membranes or substance.

The entire brain undergoes a number of vibrations and momentary compressions, of various degrees of amount, in every case of concussion where the cranium remains entire, and without any depressed portion of bone. Concussion may be either caused by a direct blow on the head, or from falling on the feet, the shock being communicated to the brain. The circulation and functions of the brain are generally only suspended for a short time, but on some occasions the patient remains insensible for several hours. The concussion may be so severe as

to cause instant death, although on post-mortem examination no lesion of structure can be ascertained; or the brain may be found soft and pulpy, and yet no rupture may be discerned; or the accident may be so severe as to cause a very distinct rupture of the cerebral substance.

In any severe injury of the head causing concussion the surface of the body is cold, the patient lies motionless and insensible, or only answering when spoken to, pulse feeble, pupils contracted and sphincters relaxed, and muscular power lost; this is the first stage, viz., depression marked by feeble circulation and insensibility, which generally lasts from a few minutes to two or three hours, and occasionally proves fatal. The second stage commences by the re-establishment of the circulation, the pulse becoming stronger and the surface warmer; vomiting generally takes place, which greatly assists the patient in regaining his consciousness. The third stage is that of extensive reaction with inflammatory symptoms. In some severe cases the patient remains for hours in the first stage, and as if completely moribund, and finally he either recovers slowly or death takes place at once from failure of the heart's action, or it may terminate in inflammation of the membranes or substance of the brain, which is called the third or inflammatory stage. On some occasions an irritable state of the brain remains, rendering the patient liable to be easily excited by any excess in living, and frequently terminating fatally within twelve months, or even more, after the injury. In other cases the memory, speech, hearing, and vision are very much impaired, or perhaps there is amaurosis or squinting. When the injury is inflicted upon the posterior part of the head, there may be loss of the muscular and virile powers.

The treatment is very different in the three stages of concussion, and also according to its severity.

In the *first stage* we assist reaction, if need be, by giving some slight stimulant, or remain, in many cases, a passive spectator, waiting for reaction and consciousness to take place. When there is great depression, warmth should be applied to the surface, and friction over the chest and abdomen, and, if necessary, stimulant enemata, &c. As soon as reaction is established we stop these restorative measures and trust more to the effort of nature.

In the first stage of concussion the circulation is weak in the lacerated part, and extravasation does not take place from the torn vessels, and they may be closed by natural means and not break out even after reaction has taken place. When reaction is hastened too rapidly the circulation is restored before the injured vessels are closed. The two errors to be avoided in the treatment of concussion is bleeding too prematurely in the first stage or that of depression, or by the too free administration of stimulants, so as to bring on reaction too rapidly; resulting either in extravasation of blood or inflammation of the brain or its membranes. The rule is to guard against allowing the depression proceeding too far, or to excite either a premature or excessive reaction.

In the *second stage* strict rest and perfect tranquillity is enjoined; cold applications to the head, and other antiphlogistic remedies, according to circumstances. Sometimes in this stage symptoms arise requiring the use of stimulants; on other occasions the reaction is too violent, and we must resort to blood-letting, antimonials, &c.

When the *third stage* has set in and inflammation is very active, antiphlogistic treatment must be rigidly pursued; bleeding, leeches, iced applications, purgatives, antimonials, &c., are the means to be employed, and when there is reason to suppose the effusion of inflammatory lymph, calomel in small and repeated doses ought to be administered, with counter-irritation.

The brain often remains weak after inflammation, and the patient requires to be carefully watched and kept quiet.

Frequently the sense of hearing, or smell, or the sight may be impaired; affections of the mind are also often the remote consequences of concussion, after the patient has been long convalescent and apparently cured. In some cases a slow chronic inflammation is set up in the cerebral substance long after the accident has apparently been recovered from, which ultimately leads to suppuration and death.

Compression.

Pressure applied to the brain produces derangement of its functions and a condition called compression, which may arise from a number of causes—from a foreign body lodged in the cranium; from the pressure of a portion of bone; of blood extravasated; or pus formed within the cranium.

The most prominent symptoms are coma and stupor, or the patient is drowsy or insensible, not answering questions when spoken to, or only when shaken and spoken to in a loud voice; perhaps paralysis, more or less complete; breathing slow, labouring, and stertorous, with a peculiar blowing by the mouth during expiration; pupils dilated and insensible to light; pulse distinct and full, often slow and sometimes intermittent; the fæces are passed involuntarily, while the urine is retained; the skin is of its usual temperature, and occasionally even warmer and perspiring; sensation is completely lost; pricking or pinching produces no signs of feeling pain; the sight, smelling, and hearing are also lost; the voluntary muscles are powerless and relaxed, and the limbs are incapable of motion. Sometimes this state of coma is succeeded by paroxysms of delirium or convulsions.

These symptoms either come on immediately or secondarily, according to the cause; they are immediate when produced by a depressed portion of bone, foreign body, or sudden hæmorrhage; secondary when they arise from slow bleeding or suppuration. In many instances concussion merges into compression, so that the symptoms of each are not distinct, and they are also often modified by the inflammatory process.

The brain seems to have the power of accommodating itself to the effects of pressure to a certain extent, although the cause which produced it should still remain—as is seen in cases of depressed fracture, when, without any elevation of the depressed portion of bone, the symptoms, which were at first those of compression, after a few days entirely disappear and the patient recovers. It is seldom that pure examples, either of concussion or compression, are met with in actual practice. The injury which causes a concussion will, most likely, also produce rup-

ture of some blood-vessel, which will lead to extravasation and compression. Or when a fracture or effusion of blood has taken place, a severe concussion is also, in many cases, likely to have been received to the brain; so that the symptoms of both these states are most frequently observed to be present in the same case, sometimes those of concussion, and sometimes those of compression predominating. Frequently the case is one at first of distinct concussion, followed, after some hours, by extravasation of blood, and when, after several days, the compression is caused by the secretion of pus.

Compression may cause death immediately from coma, or from the effects of inflammation in the injured part, or the patient may gradually recover, with or without the removal of the cause of pressure.

The *treatment* consists in the removal of the cause of compression, when possible, and the prevention of the advance of inflammatory symptoms.

There is a state which has received the name of *irritation of the brain*, and which is said to be frequently found conjoined with laceration of the cerebral substance; it sometimes exists separately, but usually supervenes upon and complicates those of concussion and compression. The patient lies in a semi-unconscious state, but is capable of being roused, and answering questions usually in a peevish, irritable manner; he moans and tosses about in bed with his arms and legs; features contracted, and as if suffering great pain; face pale; pulse slow, and skin cool. He is sometimes seized with convulsions, or violent fits of delirium, which terminate in coma, and rapidly proves fatal. The treatment to be adopted is antiphlogistic, and after the bowels have been freely opened, an opiate frequently induces sleep and quiets the delirium; but opium must be administered with great caution in all injuries of the head.

Inflammation of the brain and its membranes, in some cases, comes on very rapidly, and in a most acute form; in others, very slowly and gradually, and is mixed up with the symptoms of compression. On examination after death, the brain is found to be very vascular, and shows a number of bloody points, on making a section, and occasionally softened at some parts, in cases of a chronic character. The arachnoid is redder at dif-

ferent parts, thickened and opaque; lymph is effused over the surface of the brain, chiefly at the seat of injury, in the fissures, or at the base of the brain. There is a muddy, sero-purulent effusion at the base of the brain and in the lateral ventricles, and the sinuses are gorged with blood.

When symptoms of acute inflammation of the brain and its membranes supervene within forty-eight hours after the injury, active treatment should at once be employed, and on some occasions the means used may be successful; but more frequently symptoms of compression set in.

In these cases purulent matter will be found either collected into an abscess in the substance of the brain, or upon its surface, or, in some instances, the fluid poured out may be of a serous character. Inflammation sometimes does not set in for weeks or months after the accident, and in these cases it is very insidious, and usually terminates fatally. The symptoms may be either those of inflammation, irritation, or compression of the brain, according to circumstances. The same morbid appearance is generally observed in this—the chronic—as in the acute form, with the exception of the arachnoid being more constantly found diseased. In these cases the patient has, to all appearance, regained his usual health, or perhaps only complains of some slight head symptoms, or there is some functional disturbance of the brain, when inflammatory symptoms either come on slowly or very suddenly, and may very rapidly cause death, or the patient may live for some time quite helpless and paralytic.

The *treatment* is strictly antiphlogistic; frequent bleeding from the arm, and leeches; the head shaved and ice constantly applied; bowels freely opened; calomel in small and repeated doses, until the mouth is affected; and the patient confined in a dark room, and kept perfectly quiet. In the more chronic stage, blisters to the scalp and nape of the neck, setons, &c., are the best means of subduing the disease.

Suppuration.

Contused and lacerated wounds of the scalp, however severe, seldom slough, owing to the great vascularity of the integuments, but they give rise to extensive inflammatory suppuration and compression. Very frequently extravasation of blood takes place, which produces a soft, puffy, fluctuating tumour, which is, in most instances, removed by absorption, on the application of discutient lotions. In some cases the sero-sanguineous extravasation gives the sensation as if a fracture had occurred, on account of the margin of the contusion feeling hard, and the centre soft and depressed. About a fortnight after the accident, a swelling or tumour is sometimes observed at the site of the injury. Where there is no wound externally, and when a wound does exist, it takes on an unhealthy aspect; on some occasions inflammation comes on in the swelling, and suppuration ensues, requiring the matter to be evacuated. At first, the patient complains of general feverish symptoms; later, he becomes delirious and comatose. On making an incision into the tumour, unhealthy pus is discharged from between the pericranium and the bone; should the surface of the bone appear to be vascular, and to bleed on being scraped, it is generally considered that the dura mater adheres below, and that the application of the trephine is not necessary. If the bone does not show signs of vascularity, exfoliation, to a greater or less extent, may be expected; either of the external table alone, or of the whole thickness of the skull, should the patient survive the evils resulting from the formation of pus underneath.

Suppuration may take place in the same situations as that of extravasation of blood. When the matter is between the dura mater and cranium, a puffy tumour is generally observed corresponding to it on the scalp.

The dura mater may at once be separated from the bone, and blood effused between them, and after a few days, suppuration may take place, and an abscess form; or inflammation is set up either in the bone or dura mater, or both; in the diploe, or between the pericranium and bone externally, and purulent matter formed.

The following is a good example of a *puffy tumour* on the scalp, with inflammation and commencing suppuration, causing symptoms of compression, which were relieved by operation: No. 2901. *Fracture of skull.*—Private John Evans, æt. 25, wounded 16th April, 1855. 20th April admitted into Castle Hospital, Balaklava. Says he was blown up in a magazine in the trenches, and lay insensible for some time; received three small lacerated wounds on the left side of the head. Complained of headache and slight febrile symptoms for a few days. The wounds had healed up, and he walked about apparently well. May 14th and 15th.—He remained in bed complaining of violent pain in the head, was very drowsy and stupid-looking, and with difficulty could be got to speak to any one. 16th.—Lies in a semi-comatose state, with eyelids half closed, but is sensible when roused, and answers questions in monosyllables. Says the pain is greater and of a tight kind; right side of the face distorted and angle of the mouth drawn downwards; brows knit; pulse quick and hard; skin hot. On examining his head there appeared a small tumour, with distinct feel of fluctuation in the neighbourhood of one of the wounds; presented all the characteristics of Potts' puffy tumours. On making an incision, the pericranium was found separated by thin sanious discharge from a depressed fracture of the left parietal bone. By means of Hay's saw I was able to remove pieces of depressed bone and elevate others. The fracture was such as would be produced by a ball. The dura mater looked inflamed, and was coated by a lymph-like matter. The head symptoms gradually disappeared, but a fungus rose from the bottom of the wound. 21st.—Fungus was as large as a good-sized walnut, pulsating strongly, and had a red strawberry look; pledgets of lint soaked in Spt. Vini rect. were kept constantly applied, under the use of which it gradually went down. The wound healed, and he was discharged and sent home for duty on the 5th of July.—*Donor,* Dr. Jephson, K. D. G.

Necrosis.

When the pericranium is detached from the bone, necrosis of the whole thickness may take place, and an abscess form

between the bone and dura mater, causing compression of the brain; most frequently, however, the external table only dies and exfoliates, so that separation of the pericranium and necrosis is not a certain indication of the formation of matter between the bone and dura mater. This latter membrane is more vascular than the pericranium, and when the dura mater is detached necrosis is much more likely to occur than when the pericranium alone is separated. When the injury is so severe as to detach both the pericranium and dura mater extravasation takes place, followed by necrosis of the whole thickness of the bone and the formation of matter and also in those cases where the dura mater is separated by itself. Symptoms of compression from the deposition of pus do not take place for days or weeks after the accident, whereas that from the effusion of blood is immediate or almost so. As matter continues to accumulate, the bone becomes necrosed, and, unless evacuated, it causes inflammation and ulceration of the membrane, and substance of the brain, and death. Mr. Pott states that the local signs following a smart blow on the head and attended with languor, pain, restlessness, watching, quick pulse, headache, and slight, irregular shivering, do almost invariably indicate an inflamed dura mater, and pus either forming or formed between it and the cranium.

Cases of compression of the brain from the formation of pus below the bone, requiring the application of the trephine, are of rare occurrence at the present day compared to former years, apparently from the more active antiphlogistic treatment pursued on the first symptoms of inflammation making their appearance; and also, when a patient has received a severe injury of the head, he is carefully watched.

When purulent matter has formed in the substance of the brain, at its base or on its surface operative measures are useless. The diploe, or the veins distributed in it, sometimes inflame and suppurate, and should a fissure exist and matter be discharged in any quantity, it should be evacuated. Inflammation of the veins of the diploe is a very serious disease, on account of the secondary abscesses which frequently form in distant internal organs, such as the liver and lungs, and also from its immediate effects upon the brain itself. It is now

generally supposed that these abscesses are connected with inflammation of the veins.

Mr. Prescott Hewitt states—"It has never fallen to my lot to see a single instance in which the application of the trephine, under such circumstances, had a successful issue. In every case in which I have seen the operation performed, the patient, notwithstanding the evacuation of the matter, has died of diffuse inflammation of the membranes." Still he recommends the use of the trephine, to give the patient the only chance of recovery. "Purulent infection was observed in fourteen out of the twenty-three fatal cases of scalp wound; and although developed in other injuries, in none is it more frequently so than in those of the head, and that, too, in cases where the injury has apparently been of a trivial nature."

The well-known fact that this disease is found especially in injuries involving the osseous system will seem to explain the frequency of the development of this most formidable complication in accidents about the head, where the bones are not only abundantly supplied with cancellous tissue, but where are also found venous canals much larger and much more numerous than in any other part of the skeleton. That no cases of this kind should have fallen under Pott's notice is surprising, and the more so as Desault and others were, at about the same period, directing the attention of surgeons to this affection, as one of the most common consequences of injuries of the head. It has been thought by some foreign pathologists that the early application of the trephine made by Pott and other surgeons, in cases of exposed and contused bone, might, in some measure, seem to explain why these practitioners had not met with more cases of purulent infection in injuries of the head. M. Chassaignac, especially, thinks that the removal, by the trephine, of the contused bone before suppuration has taken place in its diploe, destroys the source from whence the secondary mischief is, for the most part, derived; but such an explanation can scarcely be admitted as a valid one; for in many cases of purulent infection after amputation we do not find extensive suppuration in the cancellous tissue of the bone; and also in cases in which suppurative inflammation did not exist in the bone previous to the removal of the limb.

Eleven cases of this description of injury were admitted from India, of whom six were sent to duty and five invalided for other diseases. In all of them, small portions of the external table of the skull came away necrosed. The scalp was not adherent to the bone in any of them.

The brain and meninges appear readily to support loss of bone by caries and necrosis, and to accommodate themselves to a denudation of osseous covering, which takes place gradually, whilst forcible removal by gunshot injury and operation is more generally resented.

The following cases are good examples of this tolerance of loss of bone caused by necrosis. No. 2895.—Three portions of necrosed parietal bone; the sequestræ embrace the entire thickness of the bone. The number of square inches of bone removed is about five and a half inches, and was taken from the superior and posterior angles of both parietal bones (see Plate I, fig. 1), from Thomas Walker, æt. 22, 95th Regiment; total service, five years; was dangerously wounded on the crown of the head at the battle of Inkermann, on the 5th of November, 1854, by a large fragment of a shell, which struck him on the vertex, producing a large lacerated wound, with extensive comminuted fracture of the upper and posterior third of each parietal bone. Immediately on being struck he fell down senseless, but got up again, and walked towards the Russian lines, in a semi-unconscious state, which he had nearly reached when he was perceived by two Bashi Bazouks, who intercepted him and brought him back. On admission into Fort Pitt Hospital the wound presented the following appearances. The two parietal bones were separated from each other to the distance of more than one inch at their upper border, and fully to the length of the posterior half of the sagittal suture. These borders projected above the scalp, forming a chasm, through which large quantities of purulent matter were pumped out at each pulsation of the brain. At the time of his admission the fragments admitted of only very partial movement, and were much too firmly attached to allow of their removal, but they gradually became sufficiently loosened from the attachment as to admit of this, which was successfully effected under the influence of chloroform. After the removal

of the bones the wound made rapid progress towards cicatrization, the discharge subsided, and the sinuses ceased to pour out purulent matter, while the patient's general health manifestly improved. . He was invalided in April, 1855, and was then in pretty good health, and was in good and cheerful spirits; his memory was somewhat impaired, but in other respects he was in possession of all his mental faculties.

The next case is an injury of the left side of the head, two inches above the ear, from a portion of shell. About six months after, a *puffy tumour* formed, which was accidentally ruptured; necrosis followed; the patient became comatose from the pressure of pus on the brain, but he recovered to a certain extent. Subsequently it was considered necessary to apply the trephine, which gave great relief to the symptoms, with every prospect of perfect recovery. The necrosed portion of bone which was removed almost entirely consisted of the external table, except a small portion, about half an inch in extent, which consisted of both tables, and it is probable that some part of the purulent matter that was discharged when the trephine was applied came from the interior of the cranium, through the aperture thus formed, and also from the diploe. No. 2896.—A large sequestrum, about six inches in diameter, composed almost entirely of the external table of both parietal bones. There are only two small portions which include both tables. There is an opening in the bone, made by the trephine for the evacuation of matter. From Private George Brookland, æt. 29; 23rd Regiment. On the 20th September, 1854, at the battle of the Alma, received a gunshot wound of the neck; in this injury the bullet entered on one side, a little behind the thyroid cartilage, and made its exit on the other, about a corresponding level and position; he was likewise struck on the left side of the head, about two inches above the ear, by a portion of a shell weighing two pounds. On the day following the receipt of the injury he was sent to Scutari Hospital, where he recovered from the gunshot wound, but the injury of the head received no treatment. There was no external scalp wound caused by the injury, but he stated that he was never free from headache, which at times was excruciating. He returned to England in January, 1855, when the pain of the head became

very much more severe, and he was insensible during twenty-one days; his head was shaved and kept constantly cool. He gradually recovered, and joined the depôt of his regiment in Winchester in June. He stated that on his way to Winchester he received a stroke, from the handle of a box, on the top of his head, from the cut inflicted by which a large quantity of matter burst out. The day following his arrival in Winchester he went into hospital, where he remained until he was invalided to Chatham. He stated that for two months he was completely deaf in both ears, and that he had been occasionally deaf since then. His sight had not been affected; had always the use of his limbs, with perfect sensibility in them; bowels and urinary organs remained unaffected; was somewhat emaciated, but able to walk about. On examining the bone by means of a probe, it was found bare over a space of three inches in diameter on the top of his head. There was a very copious purulent discharge, and the pain was said to be very great. On the 21st March, 1856, a large sequestrum having become loose, the requisite incisions were made, and the trephine was applied, and a large mass of necrosed bone, consisting of the external table of both parietal bones, were removed, and a large quantity of matter evacuated. The skin, which had become inverted, and formed adhesions to the neighbouring parts, having been dissected off, there was found little shrinking or loss of integuments. About three inches above the left ear there was a small opening in the skin, from which matter had occasionally been discharged; several sequestra, varying from one eighth to an inch and a half in length, and of a spicular form, were discharged from the aperture. At the date of his being invalided he was in good health, and could sleep on either side. His functions were healthy. The wound on the top of the head was rapidly closing, but a purulent discharge continued from the opening above the left ear, where, it appeared, some necrosed bone still remained.

No. 3626.—Necrosed portions of the bone of the cranium, about two inches in length and one and a half in breadth, consisting of the whole thickness of the skull; the lambdoidal suture runs through its centre. The piece is composed of part of the occipital and part of the parietal bones. There are also

two smaller portions; one of them is of the whole thickness, and the other of the inner table only. From Mc Gifford, an Indian Case, page 33.

The following very interesting specimen shows the extent to which necrosis may proceed before it causes death. The skull appears as if it had been indented and moulded by the fingers. No. 2910.—This cranium shows large irregular depressions and various degrees of deficiency of its parietes, in some places comprehending both tables, and in others the external only, and chiefly affecting the left side. The exposed surface of the inner table is quite smooth and compact, as well as the margins of the depressions. This was the effect of various exfoliations succeeding to a sabre wound of the left parietal bone. The patient was an African negro, with occasional violent paroxysms. Disease of four years' duration.

I may also mention the following case,* although it was not the result of a gunshot wound:—No. 3176.—A cast in wax exhibiting a greater extent of disease affecting the bones of the cranium than perhaps any other case on record, without in any way producing injury to the general health or cerebral functions. The greater portion of the vault of the skull has been removed, and there does not appear to have been the least production of new bone; still the brain in this case, when last examined by me, was, to a great extent, protected by the effusions of fibrinous matter and consolidation of parts, so as at some places to prevent the pulsation of the brain from being felt, as has been more fully insisted upon at page 31. The disease—necrosis and caries—commenced in J. Blackman, a sailor, in 1845, the result of a fall on board ship. He is now (1859) in robust health, suffering but little inconvenience from the extent of disease. He is at present an orderly in Melville Hospital, Chatham, and has recently got married. He is never affected with head symptoms, except when he indulges too freely in stimulating liquors.†

* This case has been described by Dr. Drummond, D. I. G., Navy.

† Every case here recorded is the result of a gunshot wound, except when stated to the contrary. The descriptions of the preparations are in general alone given, with a short notice of the result of the case; reference can be made, when required for further details, to the Museum Catalogue.

Extravasation of Blood.

As already stated, there are three causes of compression from external injury, viz., fracture with depression, extravasation of blood, and the formation of matter; the last of these has already been described. Extravasation of blood may take place in several situations—between the cranium and dura mater; in the arachnoid cavity; between the arachnoid and pia mater; between the latter membrane and the brain; at the base of the cranium; into the substance of the brain itself; or into the ventricles. When the blood is extravasated between the bone and dura mater it is generally collected together, and it is only in this instance that the trephine could be applied with the slightest advantage; but unfortunately the most careful examination of the history and symptoms does not enable the surgeon to ascertain the exact spot of extravasation, and there is, therefore, no means of knowing to certainty whether the extravasation is above or below the dura mater, or in the substance of the brain.

By most surgeons it is not deemed advisable to puncture the dura mater when the effusion is below it, although several successful cases are on record where this has been done.

The extravasation does not generally take place at once after the accident, at least to such an amount as to produce symptoms of decided compression, but they come on secondarily on reaction setting in. The amount of the extravasation is not of so much consequence as the rapidity with which it is effused, and much also depends upon the site where it takes place. A small quantity of blood extravasated at once produces more marked symptoms of compression than when it is poured out slowly; and when a larger amount of blood is spread over the hemispheres, it frequently causes very little disturbance, compared to a small quantity effused at the base of the brain, but especially at the posterior part of the base. In this case the symptoms are very urgent, and generally fatal.

When any large vessel, such as the middle meningeal artery, is torn, the extravasation takes place at once to a considerable

extent. The quantity of blood effused may be so great as to cause death; or the hæmorrhage may cease, and the brain accommodate itself to the pressure; or it may be gradually removed by absorption, or inflammation and suppuration may take place.

The middle meningeal artery (the one generally wounded) is lodged and sometimes imbedded in the bone, and may be ruptured at the fracture. Hæmorrhage usually takes place slowly, and the brain yields and becomes compressed by the successive layers of effused blood before it has the power to separate the dura mater from the bone. When the separation between the dura mater and bone is small, the blood effused is compressed, which in its turn arrests the flow from the artery, causing either symptoms of compression from extravasation, or those of a secondary character, resulting from inflammation and suppuration of the part, and of irritation and compression of the brain.

In some cases, where the trephine has been applied and extravasated blood taken away, the brain has regained its natural level, and the patients have regained their consciousness and ultimately recovered; in other cases the brain has still remained depressed, and in these the patients have not opened their eyes or recognised those about them, but continued in a comatose state until death took place.

Fracture without Depression; also Fissures or Counter-fractures.

The base of the skull is most frequently fractured in civil life, in consequence of these accidents taking place from falls; whereas in military practice fractures of other parts of the skull are common, and those of the base of rare occurrence, and the practice of the latter is therefore more successful.

A mere fissure or fracture of the skull is of no more importance than a fracture of any other bone, looking at it without any reference to its contents. A compound wound must always be looked upon as more serious, compared to a simple one, taking every circumstance into account.

Counter-fractures, or *fissures* which occur at a part of the skull distant from the part struck, are often the cause of pressure on the brain, either from effusion of blood or from the subsequent formation of matter. These fractures also take place at the base of the cranium, and are without any depression, and are entirely out of the reach of the trephine.

Although a counter-fracture of the parietal or temporal bone, produced by a blow on the opposite side, is a very rare occurrence, this, however (as has just been stated), frequently takes place at the base of the cranium, from a blow or fall on the vertex or back part of the head. Persons falling from a height or pitched from horseback generally fracture the base of the skull. The fracture in such cases depends upon the weight of the body pressing on the broad base of the skull, and the fissure generally extends from the petrous portion of the temporal bone, across and between the sphenoid and os frontis, and in some cases it passes into the foramen magnum, or it may take place at any part of the base. It sometimes happens that patients fall from great heights and alight on their feet, when the shock is transmitted through the spine to the base of the skull, causing fracture. In these cases it has been supposed by some surgeons, and by the late Mr. Earle and also by Sir Benjamin Brodie, that fracture of the base of the skull takes place only where the blow operates in such a manner as to impel the occiput forcibly against the atlas, and that the fracture is generally found to pass through the occipital bone.

Dr. Aran states that the exact line of fracture of the base depends almost entirely upon the part of the skull struck; thus, in violent diffuse blows by a large and heavy hammer, or by falls from great heights, when the blow is received on the vertex, the middle fossa at the base is fractured; when at the anterior part of the frontal bone, the anterior fossa; and if at the back part of the skull, the fracture takes place in the posterior fossa, with a pressure extending from the part first injured toward the base. It, however, seems to me to be still undecided whether the fissure extends from the upper part of the skull towards the base or, as I am more inclined to imagine, it originates in the base and extends upward in a lateral direction, as on examining skulls that have been fractured in this

temporal bone was easily removed, allowing a great quantity of fluid blood to escape. The centre artery of the dura mater being wounded, the man expired a few minutes afterwards.

Fracture of the External Table only.

This table may be fractured above, and forced inwards upon the diploe, inflammation and suppuration may take place, and perhaps necrosis. Fracture, with depression of the external table only, without any corresponding injury to the internal table, is most likely to occur at the superciliary ridges of the frontal bones, or in the neighbourhood of the mastoid processes, in consequence of the frontal sinuses and mastoid cells causing greater separation between the two tables of the skull than any other part of the cranium.

Fracture of the Inner or Vitreous Table of the Skull,

Without fracture or depression of the outer, is of very rare occurrence; still such an accident may take place, as the following case shows.*

This case proved fatal from compression of the cerebral substance. The question arises—would this compression have been relieved by the operation of trephining? I believe not, and for the following reasons:—first, that the compressing medium was not a fluid which might have escaped through an aperture in the cranium, but coagulated blood; and, secondly, to have operated, and punctured the dura mater when this membrane was in a state of inflammation would have greatly increased the chances of a fatal issue. The case is interesting, as showing an injury of the internal table of the skull, unconnected with any lesion of the external, and produced by a ball whose conical shape and sharp apex would have led one to expect quite the opposite injury, viz., fracture of the external table, and

* See the remarks on this subject in Mr. Guthrie's 'Commentaries,' paragraph 262, lecture xviii; and Hennen's 'Military Surgery,' p. 326, last edition, 1829.

uninjured internal. May we not also suspect that other cases of this description of fracture have occurred, and have not been observed on post-mortem examination, as took place in this instance, the fissure not being remarked until the calvarium was macerated? No. 2893. — Calvaria showing a distinct fissure, limited to the internal table, running parallel to the course which the ball had taken, with commencing necrosis. Death in thirteen days after the receipt of the wound.—*Donor*, Mr. Cowan, Assistant-Surgeon, 55th Regiment. This specimen was taken from Private James Burke, 55th Regiment, aged nineteen, who walked home from the trenches, and was admitted into hospital August 24th, 1855. He said that when at the rear a musket ball, which he found afterwards, struck him on the head. On examination, a distinct linear slit, about three inches long, and running parallel with the axis of the brain, was observed situated over the upper surface of the right parietal bone. On introducing the finger, the bone was found quite bare, but no fracture or depression could be discovered. There were no general symptoms of any serious injury of the head. The head was ordered to be shaved, and cold-water dressing applied. August 29th. — Had been progressing favorably until this evening, when the whole scalp was observed to be swollen, but not at all reddened. The œdema was greatest on the right side of the head and face. The edges of the wound looked unhealthy and green, and there was a peculiar smell from the wound; he complained of a want of power in his left arm; the muscles of the face were slightly twisted towards the right side; he could move his legs freely; a crucial incision was made through the wounds, the flaps retracted, and the bone carefully examined. No injury of its intimate structure could be detected, but a distinct black line marked the course of the ball; the pulse was small and weak; numerous free incisions were made here and there over the swollen scalp; from these wounds a great deal of serum escaped. 30th.—Symptoms of hemiplegia were more distinct; œdema of the scalp quite gone; wound looks more healthy; the bone appeared dead. September 5th.—Had one slight convulsion this morning; respiration decidedly more hurried; in consultation, no operation was deemed advisable; had been put under the influence of mer-

curials. 6th.—Was much weaker; respiration decidedly more hurried; has had another convulsion; died comatose in the evening. *Post-mortem examination, eight hours after death.*—Calvaria firmly adherent beneath the seat of this injury. On removing it, a false membrane was observed on the dura mater, corresponding exactly to the parietal protuberance, and measuring about two inches in diameter; vessels of dura mater and pia mater congested; underneath the dura mater, at the spot to which the false membrane was adherent, was a large clot of coagulated blood, of the size of a walnut, distinctly circumscribed, and extending in depth to the roof of the lateral ventricle of the same hemisphere. Portions of this clot were degenerated into a reddish grumous matter, possessing no consistence. The cerebral substance around was softened; the other hemisphere of brain was quite healthy; no effusion in either of the ventricles; the internal aspect of the calvaria *seemed at first quite sound,* but after the bone was macerated, a distinct fissure, limited to the internal table, running parallel to the course of the ball, and about half an inch in length, was perceived; the other organs of the body were healthy.

II. Contusion or Fracture of the Cranium, with Depression or Displacement of both Tables.

When the scalp is contused, considerable swelling and extravasation takes place into the cellular substance around the bruised part, which is depressed if the injury has been severe, in consequence of the vessels being paralysed and the cellular substance deadened. This swelling gives a feeling of fracture with depression, and ought always to be kept in mind, lest the surgeon comes to the conclusion that there is a depression when it is present, or that the depression is greater than it really is. The extravasation may take place either below the integuments, between the occipito, frontalis tendon and pericranium, or between the latter and the bone.

Symptoms of compression of the brain often show themselves, but their severity is no guide to the extent to which a portion of bone is depressed. Occasionally the symptoms are very slight

when the depression has been great, and the reverse has also been observed, viz., slight depression, but with decided symptoms of compression.

Fracture of the cranium may cause compression of the brain, either from the depressed portion of bone pressing upon the brain, extravasation of blood, or the formation of pus.

Symptoms of compression show themselves at once when they are caused by a depressed portion of bone, when, from extravasation of blood, they do not appear until some time after; and when they arise from the formation of matter, the patient presents symptoms of inflammation of the membranes or substance of the brain for some time previous.

In cases of compression caused by displacement, the question is whether the trephine ought to be used in all cases of depressed fractures, or in any. The older surgeons invariably had recourse to operative measures; now they are very seldom deemed necessary. The depressed portion of bone is elevated with two objects—to take away the cause of compression, or to remove a likely exciting cause of inflammation of the membrane and substance of the brain.

Eleven cases of this description of fracture arrived from India, and are good examples of fracture of the cranium, and displacement of both tables, with exposure and probable injury to the dura mater. In all of them there was a depressed and generally an adherent cicatrix, which plainly showed that there had been extensive injury and loss of bone, but in none of the cases, on their examination at Fort Pitt, about twelve months after the receipt of the wound, could the pulsation of the brain be felt, the parts having had time to contract and become consolidated by the effusion of a strong fibrous substance.

The size and extent of the depression in the bone, or certain sensorial symptoms remaining, were sufficient evidence that the contents of the cranium had been exposed. It is well known that the bones of the cranium have very little power of repairing injuries inflicted in their continuity by throwing out new osseous matter, but it does not appear to have been noticed or insisted on, that nature seems to make up for this by the gradual contraction and filling up of the loss of substance, by the deposition of fibrous matter and the gradual contraction

and consolidation of the injured parts, so as to effectually close in and protect the brain. This process is well exemplified in some of the cases of gunshot wounds that have arrived from India.

Besides these cases, Dr. Smith, Assistant-Surgeon, 9th Lancers, who served with the army at the siege of Delhi, informed me that Captain R—, of the Carbineers, and Captain E—, of the 60th Rifles, both now in England, are instances of the reparative process just mentioned. The dura mater was more or less exposed, and the pulsation of the brain visible in both these officers, but in neither, for some months past, has the pulsation been observable, on account of the effusion of fibrous matter and gradual contraction and consolidation of the perforated parts.

In several instances perfectly loose and displaced pieces of bone appear to have been removed, but in none of the cases is there any evidence or even suspicion of trephining having been performed.

After removing any loose or detached portions of bone, the expectant prophylactic treatment seems to be the one usually followed in the present day, and considered to be the most successful.

Nos. 2884, page 34; 2885 and 2886, page 35; 2894, page 37, are good examples of this kind of fracture, showing the appearance of parts some considerable time after the receipt of the wound, as also those cases from India of recovery from this injury without the use of the trephine.

93rd Regiment.—Private Jas. Campbell, æt. 19.—Wounded at Lucknow, 16th November, 1857, by a musket ball, which struck him in the centre of the forehead close to the root of the hair, and caused a compound comminuted fracture of the frontal bone; several pieces of bone have come away. July 10th, 1858. —The wound is now healed; there is a depression at the seat of injury about the size of a cherry, where all the tables of the skull appear to be removed, although the pulsation of the brain cannot be felt, and he complains of severe pain in the head. The man states that the ball is still in the head, and that the medical officers in India inserted the probe for several inches along the inner surface of the bone, and found the ball, but could not extract it. Invalided 9th August, 1858.

64th Regiment.—Private Matthew M'Glasher, æt. 39, twenty-two years' service. Wounded on the 12th August, 1857, by a portion of shell at the storming of Bassack Gungee in Oude; it struck him on the upper part of the left side of the forehead, at the upper and outer angle of the frontal bone, a portion of which was taken away two days after the wound. June 11th, 1858.—There are now two long cicatrices leading down to a deep depression capable of holding a marble, resulting from the loss of apparently all the tables of the skull, although the pulsation of the brain cannot be felt. He is in good health, and free from headache, except when he exposes himself to the sun, or stoops, &c. September 3rd.—Was sent to modified duty.

3rd Battalion R. B.—Private Charles Brown. Wounded at Cawnpore, December 6th, 1857, by a musket ball between the eyes into the frontal sinus; it was extracted forty-eight hours after. Several pieces of bone have come away. July 12th, 1858.—The wound is now nearly closed, there being only a small aperture capable of admitting a probe in the centre of a small depression; bare bone cannot be felt; and there is almost no discharge from it, and he is free from headache. September 11th.—Duty.

37th Regiment.—Private John M'Gifford. Wounded 30th July, 1857, by a musket ball in the head; the ball passed across the upper part of the occiput, severely injuring the bone, which was left quite bare; one large piece of necrosed bone, the whole thickness, came away about three months after. July 16th, 1858.—Wound healed; there is now a deep depression, about three inches in length, across the upper part of the occipital bone; also a deep groove leading down from the centre of the first depression, in the form of the letter T; always complains of pains in the head and giddiness. 17th.—Invalided.

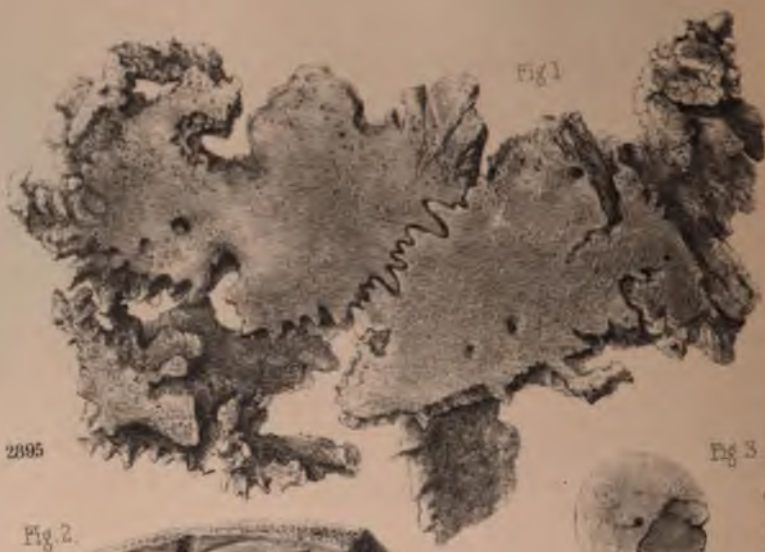
34th Regiment.—Private Thomas Long. Wounded at Cawnpore, November 26th, 1857, on the left temple, by a piece of shell, which lacerated the scalp and fractured the outer table of the parietal bone; necrosis ensued, and two small pieces of bone have come away. July 14th, 1858.—Wound healed; there is a deep depression, about three inches in length, capable of holding a finger, from loss of the outer table, and probable depression of the inner; complains of headache. August 6th.—Invalided.

53rd Regiment.—Private John O'Donnell. Wounded at Cawnpore, December 6th, 1857, by a musket ball, which struck him on the head, a little to the left of the sagittal suture, on the upper and back part of the left parietal bone, close to that suture; ball extracted immediately after; exfoliation of bone took place. July 13th, 1858.—Wound healed; there is now a deep depression capable of holding a cherry; the whole thickness of the skull seems to have come away, still the pulsation of the brain could not be felt; complains of pain in the head; remains undisposed of.

78th Regiment.—Private John Halliday received a gunshot wound in the head whilst on service in Oude, in July, 1857. The slugs, or pieces of telegraph wire, with which the wound was inflicted, struck the left parietal bone near the temporal ridge, carrying away a large portion of the scalp and bone; other pieces of bone have been extracted since the receipt of the wound, leaving a large, irregular opening, about two inches in diameter, through which the brain may be seen pulsating. Mental faculties clear; has shown no symptoms of cerebral excitement; the immediate cause of death was chronic hepatitis and ascites. Died May 29th, 1858, at Gravesend. *Post-mortem; general appearance of body.*—Abdomen and scrotum distended with fluid; both legs and feet very œdematous; a large cicatrix on the left side of the head, about three inches above and behind the ear. *Head.*—On removing the scalp over the wounded part, a small quantity of bloody pus oozed from around a small portion of necrosed bone near the temporal suture, and an opening in the skull was exposed, about the size of a shilling, having a fibrous covering, which alone separated the brain from a thin cicatrix of scalp. The edges of the opening were cartilaginous, and the bone around was rough and irregular; a considerable portion of the adjoining outer table of the skull was apparently carried away at the time he was wounded.

The following specimen shows the result of a severe contusion and fracture from a round shot, with slight depression of the internal table, five and a half years after the injury, with actual bony union of displaced fragments, and a depression of the contents of the cranium. No. 2884.—Portion of the left

Fig 1.



2895

Fig 3.

Fig 2.

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Fig 4

W. Wes

G. H. Ford.

2894

parietal bone, showing the result of a gunshot fracture. A portion of bone exfoliated, and there is now a depression in the external table, and corresponding to this there is a depressed fragment of the internal table, with smooth edges, which is reunited by new bony matter to the old bone. This specimen was taken from Private William Freeman, 80th Regiment, æt. 35, who received a severe contusion of the head by a gunshot, at Ferozeshah, December 22nd, 1845. When first under notice, there was no disturbance of the sensorial functions, and no breach of the scalp, but great tumefaction of the parts from ecchymosis; suppuration and exfoliation followed. The patient recovered perfectly, and neither then nor afterwards did he appear to have suffered cerebral symptoms in consequence of the wound. Died June 16th, 1851, of dysentery, with extensive phagedænic ulceration of the large intestines, and two abscesses in the liver; but whether the abscesses in the liver depended upon the injury to the cranium—the absorption of pus from ulcerated large intestine—is a question to be solved. On post-mortem examination, there was a slight depression in the cerebral substance and membranes of the brain, opposite to the fracture, which had a darker and more vascular appearance than elsewhere, but there was no thickening or trace of lymph.—*Donor,* J. R. Taylor, Surgeon, 80th Regiment.

The following is a good example of a considerable depressed fracture without a *single bad symptom,* and complete recovery taking place in the short space of a fortnight *without the use of the trephine.* (See Plate I, fig. 2.) No. 2885.—From Private D. Mullens, 36th Regiment. Shows a depressed fracture of right parietal bone; it projects to a considerable extent internally, and new bone is thrown out around it. The margins of the fracture are smooth and rounded off, and reunited to the old bone.—*Donor,* Dr. Russell, Surgeon, 36th Regiment.

The next specimen shows well how much the inner table is broken and depressed compared to the outer, and the appearance after many years. No. 2886.—Skull-cap, exhibiting an old reunited fracture of the frontal bone. The inner table is considerably depressed, without corresponding depression of the outer. From a soldier who was wounded in the head in Spain several years before his death.

The following is one of those obscure cases of injury of the head where, immediately after the receipt of the injury, there is no relation between the symptoms developed and the actual extent of the lesion. There must have been a large extravasation of blood in the left hemisphere immediately on the receipt of the wound; and yet the patient was able to walk home, a distance of two miles, and not the slightest symptom of paralysis was discoverable. No. 2888.—Calvaria, showing fracture of the left parietal bone, caused by a shell. The depressed portions of bone were removed, and the dura mater punctured to allow purulent matter to escape.—*Donor*, Mr. Cowan, Assistant-Surgeon, 55th Regiment. Taken from Private D. O'Leary, æt. 24, who was wounded by a portion of shell at the assault on the Redan, September 8th, 1855. From the fact of there not being the slightest general symptoms of compression, cold dressing was applied, and the case minutely watched. September 11th.—Complained of headache and sickness at the stomach. A crucial incision was at once made through the wound; the portion of bone depressed was found to include both tables; that of the external was fractured, while that of the internal was merely depressed. The opening left was about the size of a shilling; the dura mater at once protruded through the aperture and was punctured, when a reddish, semi-purulent matter escaped. The patient after the operation stated that he felt no pain and fell into a deep sleep. 14th.—Had a convulsive fit, and an excessive action of the muscles of the face and neck. 15th.—Complete paralysis of right side; he was insensible; there was a true hernia cerebri. 16th.—Died, comatose. Calvaria firmly adherent; dura mater discoloured, and softened round the seat of injury; the whole of left hemisphere presented one mass of blood and disorganized cerebral matter.

The next preparation, from Sergeant Shea, 49th Regiment, shows how a patient may recover so far from a depressed and comminuted fracture of the skull as to be able to go about and to all appearance to be in tolerably good health for fifty-four days after the accident, until suddenly seized with convulsions. It is questionable whether this man would have had a better chance had the trephine been applied, and the depressed bone

raised, on the receipt of the injury. Subsequently, when the patient was in such good health, there was every prospect of his ultimate recovery, and a surgeon under these circumstances would have had considerable hesitation in recommending an *operation, and most likely the patient could not have seen any necessity for having a hole made in his skull.* No. 2894.—Depressed fracture of the posterior part of the right parietal bone. A sharp margin of the bone must have pressed to a great extent on the dura mater and brain. (See Plate I, fig. 4.) Sergeant Shea, 49th Regiment; wounded June 7th, on the side of the head, with a piece of shell; admitted into Barrack Hospital, Scutari, July 28th. The wound had cicatrized and he appeared to be in good health. Great depression of bone could be felt. He complained of burning pain at the seat of the injury. There was not the slightest tendency to paralysis, when he was suddenly seized with convulsions at 7 a.m. July 31st, and died in about two hours. After death a large portion of the posterior part of the parietal bone was found depressed; there was a collection of blood in a fluid state between the dura mater and the bone; brain somewhat congested, but otherwise healthy.

Out of 15 cases of this description of fracture that occurred in the Crimea, and are recorded in the Museum Catalogue, 4 were not operated on, and, of these, 3 died of abscess of the brain and 1 recovered. Of 11 operated upon in consequence of symptoms of compression or inflammation, and to remove balls, 4 recovered and 7 died. In the 15 cases, none of them had head symptoms for some days after being wounded, and none were operated upon before the fourth day, and 1 as late as the twenty-sixth day, and consequently after inflammatory symptoms had shown themselves.

The following are examples of some of the cases where the *trephine* or *Hey's saw* was employed. No. 2900.—Shows the portion removed by the trephine from Private Leary, 18th Regiment. In this case the fracture was on the right parietal bone, and paralysis of the left side of the face followed, the result of suppuration in the substance of the right hemisphere and membranes of the brain. Trephined four days after he was wounded, and died seven days after the operation.

The following specimen, from Private Conolly, 1st Battalion

Rifles, shows a compound comminuted fracture of the frontal bone in the situation of the frontal sinuses. The internal table is considerably more splintered than the outer, and a portion of the bone appears to have been taken away by Hey's saw, to facilitate the removal of the loose pieces of bone. No. 2892. —Calvaria, showing fracture and depression of the frontal bone, caused by a shell. The fracture is situated on the left side, immediately above the superciliary ridge. Three small pieces of bone were removed from the wound by operation. The patient was nineteen years of age; one year's service; was wounded 26th of April, 1856, in the Crimea, by the accidental bursting of a shell, which caused a fracture of the skull above the left eyebrow. There was depression, and, after the removal of the depressed portion, he became quite sensible, and continued so for eleven days; delirium then came on, and he died on the fourteenth day after the injury. On dissection, the dura mater was found uninjured, but, beneath the seat of fracture, an abscess existed containing about 2 oz. of pus in the anterior lobe of the cerebrum, whilst the whole of the substance of the hemisphere was softened as far back as the corpora striata.

The two following, also No. 2900, page 37, were presented by Dr. Jephson, Surgeon, K. D. G.

No. 2905.—Shows several large portions of bone removed by the trephine at two applications of the instrument, from Private D. M'Kenzie, 55th Regiment. (See Plate I, fig. 3.) In this case the symptoms of inflammation of the brain and its membranes set in, and he was trephined on the fourth day after being wounded. A large piece of bone turned edgeways, pressing down the dura mater nearly an inch, required a *second* application of the trephine; almost instant relief was obtained, and the patient ultimately recovered, and was discharged to duty six weeks after the receipt of the injury.

The following preparation, from Private C. Hancock, 21st Regiment, is an example of a depressed fracture from grape-shot. Inflammatory symptoms, with excruciating pain in the head, and double vision, came on. The trephine was applied on the fifth day after being wounded. Death took place on the sixteenth day. No. 2898.—Two very large portions of depressed fracture removed by the operation of trephining; thus illus-

trating the extensive injury inflicted by grape, and the comminuted fracture which is the result.

There are also other preparations in the museum illustrating the *removal* or *forcible elevation* of depressed bone from Collins, Scribbins, Perry, and Perkins, whose cases are detailed in the second volume of the 'Medical and Surgical History of the British Army in the Crimea.'

No. 2897.—John Collins, 88th Regiment, wounded on the 13th of July, by a shell on the right side of the head, was admitted at the Castle Hospital on the 16th. On admission there was fracture, with much comminution of the anterior inferior angle of the right parietal bone, with a good deal of depression of the fractured portion plainly felt through a large lacerated wound of the scalp. During the three days he had been in the Regimental Hospital he had suffered from occasional headache; but there had been little further symptoms of head injury present. After a journey of seven miles from the front he was much exhausted, and almost in a state of collapse on admission, but came round on the exhibition of a stimulant. He complained of much headache, and begged something might be done to relieve it; but there were otherwise few head symptoms present. On the 17th symptoms of compression had appeared, the journey, probably, having aided in producing them, and it was determined to remove or elevate the depressed bone. The trephine was applied, and very many fragments of depressed and much comminuted bone removed. The dura mater was now found to be lacerated to the extent of nearly an inch, and, on separating the torn edges, the brain was seen covered with thick lymph-like matter. Almost immediately on the depressed bone being elevated he became sensible, and, towards evening, the symptoms of compression had almost entirely disappeared. On the 18th and 19th he seemed to be going on well, but still complained of headache and intolerance of light; his skin was cool; tongue clean; pulse 86. During the night of the 20th he felt something give way in his head, and, on the dressings being removed in the morning, a fungus projected from the wound, which increased rapidly during the day, till it attained nearly the size of a hen's egg, with return of headache and twitching of the muscles of the left arm. He

soon became insensible and comatose, and died on the 22nd. The *post-mortem examination* showed the dura mater to be much lacerated, and for some distance in a sloughy state. The fungus had, in great measure, receded, and the brain substance corresponding to the fracture, and beneath the fungus, looked like dirty, thick, pulpy matter, interspersed with black spots of extravasated blood. A large abscess existed in the anterior lobe of the right hemisphere of the brain. The whole external surface of this hemisphere was covered with a coating of thick purulent matter.

No. 2903.—H. Scribbens, Royal Artillery, æt. 23, wounded on the 7th June, admitted at the Castle 14th June, with a severe laceration of the scalp by shell. The bone was denuded, but to no great extent. On the 23rd it was noticed that his memory was impaired, and he was very stupid, and complained of much pain in the head, with dilatation of the pupils, and he had had several attacks of rigors. The bone felt as if fractured to the probe, and an incision was made so as to examine it. The indentation felt was found to be the parietal frontal suture. A very small portion of one of indentations was loose, and was removed, and the flaps replaced. On the following day, however, matter mixed with air bubbles was observed to be welling up between the bones at each pulsation of the heart, producing a clicking sound; and as the head symptoms were more urgent, the application of the trephine was resorted to. A portion of the internal table was found to be depressed and detached, the dura mater inflamed, but entire. On the 26th, jaundice and fever had set in, and he died on the 1st July. *Post-mortem examination* discovered a large abscess in the centre of the right hemisphere of the brain, communicating with the wound, and the surface of the hemisphere coated with pus.

No. 2904.—J. Perry, 97th Regiment, æt. 19, wounded 7th July, was admitted at Castle on the 16th of July, when a depressed fracture of the occipital bone was found to exist, situate in the median line, and a foreign body was felt by the probe to be movable, just inside the skull. The regimental surgeon reported that he had suffered from intermittent fever, with frequent relapses. On the 19th July it was determined to remove

what was thought to be the loose piece of bone within the skull, but on laying the parts open it was found to be the ball. It could not be removed without the application of the trephine, which was applied so that its edge at one spot overlapped the torcular herophili, as thus considerable facilities were afforded for the removal of the foreign body and a quantity of comminuted bone which had been driven before it. On removing the ball (a round one), it was found that it had been caught on the edge of the unfractured bone in a way not explicable without the aid of a drawing, five sixths of its diameter being within the skull; and that it would appear that it had become loose on the process of suppuration being set up, when it had dropped entirely into the skull. The comminuted fragments of bone were carefully removed after the extraction of the ball, as well as a portion of his cap. The point of a small, sharp spiculum of bone was found to have penetrated the torcular, and its removal was followed by venous hæmorrhage. This was easily arrested by a small fragment of sponge, and gave no trouble. The dura mater was intact. He went on well till the 1st of August, when he was seized with fever of an adynamic type, with congestion of the lungs, but without symptoms referable to the head; this was the more remarkable, as most of the fevers at that time occurring showed a great tendency to head congestion. From this disease he died on the 7th of August, the wound being nearly healed at the time of his death. On post-mortem examination, no traces of inflammation of the brain or of its membrane were found. A small portion of brain substance appeared wanting, giving the idea that it had been absorbed under the pressure of the bullet. The dura mater was entire and healthy. A minute opening, closed by plastic lymph, existed into the torcular, but the interior showed no trace of inflammation. It appears probable that this might have proved a recovery from the so much dreaded operation of trephining, but for the intercurrent disease.

No. 2899.—J. Perkins, 44th Regiment, was wounded 18th June, and admitted at the Castle 21st June, suffering from lacerated wound of scalp inflicted by shell. An angular fissured fracture of bone existed, the angle of which was very slightly depressed. On the 23rd June, slight symptoms of compression

with a febrile state had appeared. The bone was cut down upon and fully exposed, when a portion of hair was found driven into the fracture, and firmly impacted. The depressed angle was taken out, by including it in the circle of the trephine. The inner table was displaced to a greater degree than the external, was comminuted, and two pieces lay quite loose and detached. Some amount of clotted blood was found on the dura mater, which membrane was, however, entire. The hair did not go through the fracture, but was only driven between the fractured edges of the external table. The head symptoms were almost immediately relieved by operation; he had no further bad symptoms, and he went to England well, with the wound healed, on 28th July.

III. Penetrating and Perforating the Cranium and its Contents.

The bullet, or a portion of it, is often lodged, and sometimes fragments of bone are depressed or driven into the brain. Leaden balls are generally flattened by striking against the bone; sometimes they are cut into two, one portion of which lodges and the other flies off (No. 2883, page 45; and 2902, page 47) at various angles, according to the obliquity of the projectile, force, &c., or it may remain under the scalp at the margin of the aperture, while the other portion entered the cranium (No. 2891, page 47). Laceration of the membranes and brain is usually followed by inflammation; still, very severe fractures with depression, and even with the lodgment of extraneous bodies, have not proved immediately fatal. However, there can be no doubt that these injuries are very dangerous.

The first thing to be done is to take away any loose fragments of bone and to elevate any depressed portions that can be raised without any additional injury to the brain, and likewise any foreign body that can be found.

When the brain has received a contused or lacerated wound, the anticipated inflammation is to be averted by the usual means, and protrusion is to be prevented by compress and bandage tightly applied.

The internal table is generally splintered to a greater extent than the external, and this is said to be caused by its greater hardness and brittleness. But it appears to me to depend, in some measure, upon the direction in which the *force is applied;* and that splinters are seen most frequently on the *inner side* of the skull is to be accounted for by the force being, in most cases, applied from *without inwards.* When the force is applied from *within outwards, the external table* is found to be much more splintered than the *internal;* as is seen when a ball has passed completely through the cranium and brain, as in No. 2881, page 44.

The surgeon, before commencing an operation after extraneous bodies within the cranium, ought to weigh well the evils likely to ensue from such a search. When a ball is felt or can be traced without much injury to the patient, every endeavour should be made for its extraction; but when the course or actual site of the ball or other body is unknown, no surgeon ought to make any great search, on account of the probable difficulties in finding the foreign body, and also from the known fact of many patients having survived with the balls and other foreign bodies between the cranium and dura mater, and even within the brain itself, without producing fatal results.

None were admitted under this head from India.

Unfortunately, men's heads are not what they used to be, or modern missiles are more deadly, for recent wars furnish not one exception to the fatal consequences of this species of wounds. Of ninety-one cases of penetrating and perforating gunshot wounds of the head, admitted into hospital in the Crimea between the 1st of April, 1855, and the end of the war, all, without exception, proved fatal. The details of these cases, had they been given, would, however, have been instructive, as showing that what are called symptoms of compression occur equally when a portion of cranium and brain is shot away, and the cerebral substance left without cover and support. Mr. Hennen notes the case of a soldier who had nearly half of the roof of the skull blown off by the bursting of a shell, and who had no untoward symptoms till the tenth day, when the brain got into a fungous state, and protruded to a great extent,

and (Mr. Hennen adds in italics) "*he died comatose, with all the symptoms of compression.*" *

The following is a good example of a perforating gunshot wound of the skull, and shows extremely well the usual characters of the aperture at the entrance and exit of a musket ball. The outer margin of the entrance of the ball is seen to be smooth, and its inner surface larger and more irregular, and (in this case only slightly) splintered; the internal table being generally splintered to a greater extent than the outer, which is thought to be owing to its being more brittle. The entrance and exit of the ball in this skull show that this appearance is rather produced by the injury proceeding from without inwards, and also from the force of the ball becoming less in passing through the outer table. No. 2881.—Skull-cap, exhibiting two perforations made by a pistol ball in the anterior and right side of the frontal bone, and in the posterior part of the left parietal bone. The ball entered in the former situation, and lodged in the latter. The first opening is round and smooth; the second is regular on the *inner* table, but the *outer is torn up to an extent* much larger than the *ball*, which is lodged in front of the splinters. From an officer who was killed in a duel.

The following specimen shows the result of a gunshot fracture, where the patient survived fifteen weeks after the injury. It is to be presumed that any loose splintered pieces of bone (if any existed) were removed by the surgeon, and in all probability other portions were driven into the brain along with the ball; still, the man lived for some time, and became convalescent, with the ball in the lateral ventricle. The internal surface of the bone shows marks of vascular action, with slight osseous deposit around the opening. Three large wormian bones are seen in the preparation, and the gunshot hole is through two of them. No. 2882.—Portion of a cranium in which is a circular perforation made by a musket ball at Waterloo. The external margin of the hole is sharp, but the internal is rounded off, and of somewhat larger diameter than the former. The ball lodged in the brain. The man, however, became convalescent, until he was attacked with apoplexy fifteen

* Hennen's 'Military Surgery,' p. 353, last edition, 1829.

weeks after the wound, and died. The ball was found loose in the lateral ventricles, having shifted its original position.

The next preparation, from Private William Doyle, 19th Regiment, is very interesting, and shows:—"1st. That a ball may be cut in two by striking the margin of the fractured bone, and in such a manner as to leave a smooth surface on the ball, as if it had been cut by a sharp instrument, and one portion of bullet to enter the cranium, causing fracture, depression, and splintering of the internal table. 2nd. That in all probability the depressed portion sprung up or was forced up by the motion and resistance caused by the brain. 3rd. That a bullet may enter the cranium without leaving an aperture in the skull, but merely a slight depression and fissure, and leaving no evidence of its having entered the skull during life, until found on post-mortem examination. 4th. That the internal table is more splintered than the external. 5th. That the trephine may be applied without the surgeon being able to take away splintered portions, or to find the ball; in this case, however, there was no evidence of a ball having penetrated. 6th. It also records a wound in the superior longitudinal sinus, with extravasation of blood on the brain. It also shows that the want of an apparently sufficient opening does not prove that the ball has not penetrated and lodged, as the elasticity of bone is such as to diminish the aperture to a considerable extent. The patient survived the wound five or six hours only. No. 2883.—Lodgment of part of a rifle ball in the brain, without the usual evidence of a hole in the cranium. Portion of cranium with a depressed fracture by musket ball. Portion removed by trephine. Portion of rifle ball found in cerebrum.—*Donor*, T. Longmore, Surgeon, 19th Regiment. This patient, æt. 19, was wounded in the head by a rifle-ball in the advanced trenches of the right attack, 13th August, 1855. The scalp and pericranium were cut about two inches, and a portion of the cranium about an inch in length, and half an inch in breadth, a little in advance of the posterior and superior angle of the right parietal bone, and close to the sagittal suture, was depressed. According to statement, the man was rendered perfectly senseless and motionless from the instant of being struck by the ball; so much so that at first he was supposed to be dead.

On being conveyed to camp he presented all the usual symptoms indicating compression; pupils dilated and fixed, surface warm, unconsciousness, complete paralysis, &c. On examination of the depressed portion of the bone no opening whatever could be felt; the edge of the sunk bone and the bone adjoining were in contact, and it was presumed to be an ordinary case of fracture and depression. Some very minute portions of cerebral substance were observed to be mixed with the clot about the wound, such as might be squeezed through a fissure. Trephining being determined on, it was performed at once, and the depressed bone raised without difficulty. No relief whatever followed; the dura mater bulged slightly upwards into the opening. On passing the finger over the surface a little beyond the space exposed by the trephine, a defined cut edge was felt a little more than an inch in advance of the site of the depressed piece of bone, being the boundary of an opening into the cerebral substance. Three hours after arrival in camp the patient sank. On *post-mortem examination* a wedge-like section of the ball (weight of section of ball 4 dwts. 5 grs.) was found to have entered and penetrated the cerebrum, and was discovered in the anterior lobe on the right side, just above the orbital plate; it had not completely penetrated, but was lying just above the membrane, covering the lobe. The ball, a conical rifle ball, with cuneiares, was cut smoothly from apex to base, as if by a sharp knife. This must have been done by the edge of the broken bone, above the opening made in the parietal bone, one half of the ball flying off, the other entering the skull. On close examination several minute points of lead were found to be imbedded along the fissured margin alluded to. The depressed piece of bone, directly after the section of the bullet entered, must have sprung up again by its own resilience, or been forced up by sudden pressure from within, so that no evidence of an aperture, but merely a depression and fissure, remained. The inner table was separated, and nearly detached from a space rather more extensive than that of the depressed part of the outer table. The superior longitudinal sinus was wounded by the sharp edge of the broken inner table, and a considerable quantity of blood extravasated upon the surface of the brain."

No. 2891.—Skull of a Russian killed at the battle of Inkermann. Half the bullet is under the scalp close to the opening in the skull, made, it is presumed, by the other half which entered the cranium.

The next specimen, No. 2889, is interesting as showing the great extent of injury inflicted on the osseous substance by a conical musket ball, which perforated the cranium. Not only are both openings joined by a well-defined fissure, but there are cracks radiating in all directions from both wounds. It is curious that portions of the bone large enough to allow of the easy introduction of the finger were removed, which had been driven before the ball, and escaped with it through the aperture of exit; only a few loose spiculæ were found in the substance of the brain itself.—*Donor*, Mr. Cowan, Assistant-Surgeon, 55th Regiment. This is from Private R. Davis, 55th Regiment, æt. 23, who was admitted into hospital 24th July, 1855; a musket ball was found to have perforated the cranium at the right superior angle of the frontal bone, and having traversed the substance of the brain, made its exit at the superior angle of the right parietal bone. He had all the symptoms of severe compression of the brain; deep insensibility, involuntary action of the sphincters, contraction of the pupils, &c. Portions of the cerebral substance escaped at both openings, and on introducing the finger, loose pieces of bone could be detected. There was scarcely any hæmorrhage; the breathing became stertorous, and he died six hours after admission.

The ball in the case of Private Thomas Cain, Rifles, was split, and penetrated the dura mater and brain to the extent of an inch, and was extracted twenty-four days after the wound was received, and the depressed bone was elevated on the twenty-sixth day. There was an extensive abscess in the right lobe of the brain, and pus on the surface and in the ventricles, with fungus preventing the escape of the matter. No. 2902.—Shows the portions of bone removed by the trephine, and also the musket ball, split.—*Donor*, Dr. Jephson, Surgeon, K.D.G. "The patient was admitted into hospital, Balaklava, 16th July, 1855; had been wounded, 23rd June, in the trenches. Has a jagged lacerated wound of the scalp behind the right ear, and a fracture of the right parietal bone above its posterior and external angle

has been felt with a probe. On the 18th the febrile symptoms and headache were more urgent, and he had been delirious during the night. The wound was enlarged to examine the fracture, when I found and extracted the ball (attached), which was split at right angles, the small angle resting on depressed bone and level with the surrounding bone, which accounts for depressed fracture not being found with a probe; the other angle was more than 1¼ inches sunk in the brain. With some difficulty I extracted the ball; considerable hæmorrhage took place from the wound, and he became weak and so much exhausted that the depressed bone could not be elevated or removed without trephining, and was not meddled with. After a few hours he came round, and said the pain was nearly gone; sat up, examined the ball, and talked of being shortly able to have another go at the Russians. The following day the pain returned; the muscles of the left side of the face became paralysed; and high febrile symptoms came on. Some small pieces were removed from the bottom of the wound, but some larger ones, pressing on the brain, could not be removed without trephining. Chloroform was given at his own request, and the operation performed. The dura mater was found extensively lacerated by the ball and by pieces of bone; for three or four days he appeared going on well, and the febrile symptoms subsided, when a large fungus of brain-like matter projected from the wound. The fungus increased rapidly, and profuse discharge of thick purulent matter came from within the skull on each pulsation of the brain; when he turned over on his left side I cut away the fungus in slices, applied Nit. Argenti, &c., and pledgets of lint soaked in Spt. Vini rect., but it grew as fast as ever. He gradually lost flesh, and hectic symptoms came on, but he complained of little pain in the head. On the 17th August he was delirious during the night, and tore off the dressings from the wound, together with a large piece of the fungus; towards morning he became comatose and breathed somewhat stertorous; pulse 78. Lay on his face and hands, and when disturbed moaned very low as if in distress. No discharge from the wound even on turning him over on his side. I introduced a director, pressed the fungus upwards and backwards into the skull, when about 3 drs. of thick pus came from between the brain and dura mater. The symptoms of compression were

immediately relieved, but returned when the matter accumulated to the same extent, and could not find an exit in consequence of the pressure of the fingers, but was relieved in the same way. On the 21st August he became more comatose than before; towards the evening he died. The fungus at first was very soft, but for some time it had been very hard and elastic. On a post-mortem, extensive abscess was found in the posterior and middle lobe of the right hemisphere, communicating freely with extravasated matter on the surface of the brain, and by a recent opening with the lateral ventricle. The dura mater was detached from the bone around to a great extent, and presented a sloughing appearance."

The following is a gunshot wound of the face and base of the skull; death ten days after the injury, from hæmorrhage from the internal carotid, splinters of bone in the left hemisphere, and suppuration. No. 2880.—Cranium, exhibiting the track of a musket ball, from the lower and inner side of the right orbit to the carotid canal, in the petrous portion of the left temporal bone. The internal carotid artery was ruptured, and the ball lay near the opening; spiculæ of bone were entangled in the substance of the left hemisphere of the brain, and suppuration had commenced in this part.

No. 3197.—Cast of the head of a man who received a gunshot wound in the right anterior lobe of the brain when attempting suicide. This is a good example of a gunshot wound penetrating the substance of the brain, with recovery without any operative measures. From Private Daniel Tonson, 24th Regiment. Sustained an injury on the back of the head by the barracks at Loadianah falling upon him in 1846. The nature of the injury is not clear, as the scalp was not broken, and there is but a slight dent to be felt in the occipital bone. The skull, however, was supposed to have been fractured. He was after the injury subject to headache, though still doing his duty. In 1853, whilst under the influence of drink, he attempted suicide by leaning his right eyebrow on his musket, and firing a ball through the right anterior lobe of his brain. The ball entered the orbital plate of the frontal bone at the side of the nose, and passed out near the coronal suture. The bone seems to have been comminuted, and there are now, January, 1859, irregular

elevations and depressions, and a puckered cicatrix with a notch in the superciliary ridge marking the entrance of the ball. The sight of the eye is good, and he is in robust health. He is of sound mind and perfectly rational so long as he abstains from liquor. *Donor*, Dr. Williamson, S.S.

IV. Sabre and Bayonet Wounds of the Head.

Simple Incised or Lacerated Wounds of the Scalp caused by Sabre Cut, or by the Bayonet, but without Fracture of the Skull.

Simple incised or lacerated wounds of the scalp from sabre cuts should be brought together by adhesive plaster, and every portion of the scalp which has been detached from the bone should be saved, so as to afford protection and nourishment to the subjacent parts and to hasten the cure.

In some cases, however, it may be necessary to insert sutures to retain the parts in apposition, but this ought to be avoided as much as possible. When the flap of the scalp takes place from above downwards, or when its base of attachment is large, it reunites more quickly than when it is raised in the opposite direction, on account of the principal nutrient vessels not being divided.

When punctured wounds occur on the upper part of the cranium, between the scalp and bone, a puffy erysipelatous swelling, with tension and tenderness of the scalp, is very liable to ensue. For the relief of this, the chief treatment consists in free incisions, to allow of the discharges of blood from the arteries, and also to prevent the formation or lodgment of matter over the bone.

The erysipelatous inflammation which is so extremely liable to occur in wounds of the scalp, is thought to depend upon the peculiarly dense texture of the scalp and on the tendinous expansion of the occipito frontalis muscle. The use of stitches and adhesive plaster has also been said to be the cause of erysipelas, but this disease frequently supervenes where neither have been used. The treatment is that usually employed in injuries of the head.

Simple Incised, Punctured, or Lacerated Wounds caused by Sabre or Bayonet, with Fracture of the Skull.

Wounds caused by the sabre or other instrument, which has laid bare or cut the bone, are always to be looked upon as dangerous.

The longitudinal sinus has been on some occasions wounded without a fatal result, and hæmorrhage from it as well as from any of the arteries are easily controlled, and do not require ligatures.

The bones of the cranium are seldom penetrated by the bayonet, and when it does occur it usually proves fatal, but should the patient survive, any depressed or projecting spiculæ of bone should at once be removed. Should a clean cut have been made by a sword or any sharp instrument, so as to leave the base of the detached portion still partially adherent, it ought to be allowed to remain, when it will form a great support to the brain, and ossific union may take place.

The cut of a sword or any clean-cutting instrument occasionally produces a mere solution of continuity, and, in some cases, it causes a fracture or fissure *which extends further than the part actually cut by the sword.* Should the wound only have penetrated the outer table and diploe, it ought to be treated as a simple incised wound. When the inner table is implicated it is usually broken and jagged to a greater extent than the outer, which externally may only show a clean cut, whilst the inner table is driven into the substance of the brain. These cases give rise to symptoms which, some time afterward, might require the use of the trephine. The depth of the wound in the bone may be ascertained to a certain extent by the careful introduction of the flat end of a probe or quill, and by the presence or absence of resistance to its further passage.

No. 2909.—Calvaria of an officer of the 98th Regiment, who was killed at Peshawur. There is a large deep cut through the upper part of the right parietal bone, extending into the left; the blow seems to have been from behind, and a second blow or cut seems to have taken away a portion of bone imme-

diately below the other. Death twenty-two days after the injury. Captain G— was attacked by some of the natives of Peshawur when taking an evening ride outside the cantonments in 1849. He received a sabre cut on the back of the head, and another on the right hand, severing the fore and next fingers, also on the left wrist through the ulna, besides several flesh wounds. Four days before death he became feverish, and symptoms of inflammation and effusion of pus on the brain made their appearance.

In the following preparation the cut is seen to have gone completely through both tables for some considerable distance, and then the fracture or fissure seems to have *extended much further*. No. 2907.—Skull cleft by a sabre cut through the occipital and parietal bones.

In the next specimen, No. 2908, cranium exhibiting an extensive wound of the occipital bone, supposed to have been made by a cutting instrument. It seems to have been a blow from above downwards, cutting clean through the occipital bone for several inches, and then the *fracture to have extended further* from the force of the blow.

Many cases of fractures may also be classed with *punctured*, or what are called *starred fractures*, where numerous fissures radiate on every side of the depressed portion of bone, and some sharp spiculæ either project into or are driven entirely into the brain. In some cases of punctured fractures with a small, narrow-pointed weapon, it is necessary to cut down upon the fracture and ascertain the exact condition of parts, and also to find out under what circumstances the injury was received and the kind of instrument which caused it.

Wounds of the Orbit, etc., are always very dangerous on account of the close proximity of the brain, and are usually produced by any sharp-pointed weapon, such as a bayonet or sword, by a walking-cane or tobacco-pipe, penetrating the thin superior wall of the orbit and entering the brain, causing inflammation and abscess. The orbital plate of the frontal bone and the ethmoid are very thin and fragile, and the anterior lobes of the brain can easily be reached either from the nostrils or orbits, and a wound in either of these situations may even take place without exciting the suspicion of the surgeon that any serious injury has been inflicted, until symptoms of inflammation of the

brain set in; more especially as the wound externally may appear of a very trivial character, as occurred in the following case, No. 2794.—The bones of the face, and a portion of the cranium, with the broken extremity of a cane which had penetrated into the nostril at the left ala of the nose, and entered the inside of the skull immediately below the left optic nerve, carrying before it the left posterior clinoid process.—*Donor*, Dr. Anderson, Surgeon, 12th Royal Lancers. "Trumpeter E. Grainger, 12th Lancers, æt. 30; death two days after the accident.* *Sectio Cadaveris, sixty-three hours after death.*—Cranium. After dividing the falx cerebri, the anterior lobes were raised; and gradually proceeding backwards we had got as far as the division of the optic nerves, when the scalpel struck suddenly on a metallic point or substance directed upwards and backwards, and protruding into the cavity of the skull close to the left side of the sella turcica of the sphenoid bone, and pressing or lying on the left optic nerve, or left side of the optic commissure. The cause of the man's death was at once made manifest, as the foreign body was evidently the brass point or ferule of a small walking-cane. On probing the nostrils the end of a foreign body could be detected; and before it was removed from the situation it occupied in the skull, it was evident that it was the end of a cane, of which the ferule or brass point presented itself in the inside of the skull, by the side of the posterior clinoid process of the sphenoid bone. The point of it had pierced the left ala of the nose, at the junction of the cartilage with the bone, taking a direction upwards, backwards, and a little inwards. In its course it grazed the inferior and middle turbinate bones, passed through the great cells in the body of the sphenoid, breaking off and carrying before it the posterior clinoid process, and finally impinging upon, but not rupturing the membranes, covering that portion of the anterior lobe of the brain in immediate relation to the optic nerve of the left side. Anatomically speaking, there was nothing to oppose the onward progress of the stick, for in fact it passed up the nostrils; the only resisting part after it entered the skin and cartilage being the body of the sphenoid itself, which in the present

* For a full account of this case, with an illustration, see 'Dublin Quarterly Journal,' vol. xi, p. 347.

instance was very slight, its walls affording almost no resistance in consequence of their extreme thinness. It is evident that while fencing, as he had described, the cane had accidentally struck the unfortunate man's face, probably from his own act in parrying the thrust, and that the point of it entered through the left ala of the nose, passing obliquely upwards and backwards until it emerged as described, by the side of the sella turcica. It is probable that the cane was broken off short in the nose when it was being withdrawn by his assailant. There can be no doubt if a detailed and accurate account of this unfortunate fencing match had been obtained at the time of the patient's admission into hospital, and the stick which inflicted the injury had been produced (which was done after the man's death), that the attention of the medical officer would have been directed to what he, without any further information than the patient's negative statement, considered only as a trivial puncture in the ala of the nose, and which would, undoubtedly, have led him to ascertain that there was a foreign body impacted within the nostril, and probably pressing backwards so as to touch the brain. Dr. Anderson is, however, inclined to think that had all the above information been obtained at the time, the foreign body might not have been extracted from the situation it occupied in the man's skull, as it required considerable force to drive it with a punch and hammer from within outwards in the dead body; and if it had been extracted, the question arises what chance was there of a fatal termination being averted."

The following is a good specimen of a *punctured wound* of the cranium. No. 2792.—Left orbit exhibiting a small punctured fracture of the orbital plate of the frontal bone, just above the os unguis. The margins of the fracture were driven inwards. Produced by an accidental wound by a bayonet. The wound in the skin was very small and soon healed; fever, then coma, and death on the twelfth day. A small triangular portion of the fracture projected inwards, and was sticking in the dura mater; the membranes of the brain were inflamed near the wound, and covered with puriform matter.—*Donor*, Dr. Young, Surgeon, 95th Regiment.

V. Circumstances under which the Trephine should be employed.

The only cases in which the trephine is advocated by some surgeons of the present day are the following:

1st. Gunshot or depressed fractures when cerebra symptoms have made their appearance, and are persistent.

2nd. When the surgeon is tolerably certain that blood or purulent matter exists between the bone and dura mater, but only when very urgent symptoms of compression come on, and resist all treatment.

3rd. Also in some few and rare cases of compound (supposed to be starred or punctured) and even simple fracture with marked depression and compression, but only when symptoms render such a proceeding indispensable.

Military surgeons are much divided upon the question as to the propriety of applying the trephine, whether head symptoms present themselves or not, in all *gunshot depressed fractures*, with the view of averting inflammation of the brain and its membranes, and consequent abscess, &c., which are very likely to ensue unless the cause of irritation is removed; such an injury being considered by some a sufficient warrant for the operation. Other surgeons consider it expedient to wait until it shall become evident whether any operative measures will be required at all, as there are many cases on record where patients have recovered from gunshot depressed fractures without an operation, and especially as it is well known that men receive gunshot injuries, perhaps, with only a small wound in the scalp, and with slight depression, and suffer no inconvenience from it, and do not even complain of headache, but actually continue to do their duty. It would, therefore, be difficult to persuade men, under these circumstances, to have an operation performed, and a surgeon would also hesitate in recommending such a course, especially as he cannot, in the great majority of such cases, be certain of the condition of the parts within the skull. It is, therefore, the opinion of several military surgeons of great experience, that the best course is to wait and

see the result, and at the same time use the most antiphlogistic measures. At present the number of cases is not sufficient on both sides of the question to enable the profession to come to any definite conclusion on the point.

In the Crimean war, 4 out of 15 cases were not operated on, and 3 died of abscess of the brain, and 1 recovered; of 11 operated upon, in consequence of symptoms of compression or inflammation and to remove balls, 4 recovered and 7 died. In the 15 cases, none of them had head symptoms for some days after being wounded, and none were operated upon before the 4th day and as late as the 26th day, and, consequently, after inflammatory symptoms had showed themselves.

In the *second description* of cases the trephine is only admissible when the *extravasation* is supposed to have taken place from the *meningeal artery*. In a few rare cases a surgeon is warranted in trephining at the seat of the injury to remove the coagulated blood, when it is tolerably certain from the situation of the injury being in the course of the meningeal artery, and the gradual coming on of symptoms of compression, that the blood may be reached and removed. But the great difficulty is for the surgeon to determine the situation of the effusion, should it be poured out over the surface of the brain, below the dura mater, or at the base of the brain; in these cases it cannot be got at and taken away. In many cases where there are symptoms which warrant the surgeon in diagnosing extravasation, still, on making an exploration, none may be found; also the frequent occurrence of fracture of the base of the skull, and likewise of extravasation into the substance of the brain, ought also to be taken into account before resorting to an operation. In almost all cases, therefore, of extravasation of blood, the antiphlogistic treatment is recommended, and only in those cases where the symptoms are urgent and caused by a blow in the meningeal region, conjoined with hemiplegia on the opposite side, should the trephine be applied; but this operation should not be performed when symptoms are not present indicating its necessity, merely because the injury is situated in the course of the meningeal artery.

With regard to the application of the trephine in cases of the *formation of purulent matter*, it should be resorted to only

when it is certain, by the presence of both local and constitutional symptoms, that pus has actually formed. The trephine should be of large size, and applied over the dead portion of bone, and afterwards strict antiphlogistic treatment should be pursued to subdue the inflammatory symptoms. Should the matter not be found superficial to the dura mater, this membrane is only to be punctured when it protrudes through the aperture, does not pulsate, and is either of a very dark or very pale colour, and fluctuates; should the dura mater present a healthy appearance, level, smooth, shining, and of a brown colour, and pulsating, it should not be interfered with; should the surgeon not find the matter, he is hardly warranted in making a second exploration. The abscess is, however, seldom situated at any other place than that which a judicious surgeon would select. Still many cases of extensive necrosis and suppuration occur, without requiring the use of the trephine. See Nos. 2895, page 19; also 2896, page 20, and 3176, page 22.

In the *third description of cases*, viz., *a compound or even simple fracture, but with marked depression and compression*,—in such cases where the urgent symptoms continue and resist every antiphlogistic treatment, the trephine may in some rare cases be absolutely necessary to save life, but it should not be resorted to unless under the most pressing circumstances, as it is now well ascertained that patients recover with large portions of bone depressed upon the brain (see Nos. 2884, page 34; and 2885, page 35), and also from the usual known fact of the powers of the cerebral mass of accommodating itself to its compressed position, and likewise the risk of converting, in the case of simple fracture, into a compound one; although too much importance should not be attached to this when circumstances demand the use of the knife. Many army surgeons, of the highest standing, recommend that the trephine should not be had recourse to in any case of fracture of the cranium, unless head symptoms absolutely requiring its application should present themselves, and thereby almost discarding the use of the trephine; and certainly the latter practice appears to be as successful as that of the indiscriminate use of this instrument by the older surgeons. Still, there can be no doubt that there are occasionally cases where the trephine can be used with

advantage, and be of great service in saving life, when resorted to with discretion. On the other hand, preparations Nos. 2882, page 44; 2884, page 34; 2885, page 35; and others, show that patients recover from severe depressed fractures without the trephine. Mr. Guthrie states that if any ten healthy persons were trephined in an hospital, one would in all probability die from the effects of the operation, and three or four from inflammation of the brain and its membranes, and the other consequences which would probably ensue. It is not the admission of air that is to be dreaded in these cases, but the same kind of irritation which often follows the abstraction of a piece of bone, under other and more ordinary circumstances, at a later period of time.

Mr. Taylor, C.B. and I.G., in his "Explanatory Observations on his Classification of Wounds and Injuries received in Action," makes the following remark on the subject:—"The information to be derived from reports and details of occasional cases of any one species of gunshot wound is imperfect, or even apt to mislead, when viewed apart from the general result in all similar cases. Cases of extraordinary recovery and of very gratifying success naturally obtain great prominence and acquire undue influence on after practice. It is thus, I am inclined to think, that the marvellous results recorded now and then as a consequence of trephining have brought that operation into unmerited repute in gunshot fractures with depressions. Let the value of this operation be tested by the results in all cases of fracture with depression, whether the trephine be employed or not. I have heard and read of magic-like, immediate, and even, though more rarely, permanent beneficial changes consequent on trephining, but I have never had the good fortune to witness a case of the kind, though I have diligently sought for one. I have seen a great many die after this operation, some of whom might have lived, perhaps, had this operation been omitted. So great, however, is the weight of authority in these cases, that symptoms of compression, as they are called, are no sooner set in than the patient is trephined as a matter of necessity. The natural history of a number of such cases otherwise treated is not known, and perchance not likely to be ascertained. Of the few who recover after trephining there is

often fair room for question whether the recovery might not equally have taken place without the operation. I must here remark that I limit these observations to *gunshot* fracture with depression, as an opposite opinion appears to be deducible from the recorded experience of trephining in similar injuries as occasioned by accidents in civil life."

Some surgeons, also, do not employ the trephine in any description of cases of injury of the cranium, but advocate leaving everything to nature, except taking away any loose pieces of bone or foreign body that can be removed without injury to the brain; and this seems to be the practice generally pursued amongst army surgeons of the present day.

VI. Operation of Trephining.

The scalp is to be divided by a circular or a V incision, or the wound may be enlarged in any suitable or convenient manner,—then the central pin of the trephine is to be protruded about the eighth of an inch, and well fixed and firmly placed on the external table, and with a sharp, light, rotatory movement of the hand the teeth should be carried into the bone. The external table and diploe may be quickly divided; the central pin should be withdrawn lest it perforate the bone first and injure the dura mater. Greater caution is required as the instrument approaches the vitreous table, or where the thickness of the bone is irregular, or where the diploe is almost wanting. The saw must be very lightly and cautiously used and taken out, the teeth cleaned, and the groove examined with the flat end of a probe or a quill to ascertain that it is of the same depth all round. When the bone is loose it may come away with the trephine, or the elevator is to be employed to raise the loosened portion. A circular piece of bone is taken away in this manner in cases of purulent collections, or extravasation of blood, or a foreign body in the cranium. A little more than a semicircular portion of bone should be removed in cases of depressed fractures; the central pin should be fixed on the margin of the sound bone, as the object of taking away a semicircular piece only is to allow of the introduction of the elevator to raise the depressed portion of

bone. It is sometimes necessary to trephine at the frontal sinuses, when the external table should be removed with a trephine of larger size, so that the internal table may be more easily reached. Hay's saw is sometimes very useful in removing portions of bone. The scalp should be replaced, sutures if necessary inserted, and cold water applied, and antiphlogistic measures adopted to avert inflammation of the brain and its membranes, or of the veins in the diploes or in the sinuses, which may suppurate and quickly prove fatal.

The opening made in the skull by the trephine is filled up by the same process as takes place in the formation of new bone in other parts of the osseous system; the pericranium, dura mater, and bone all assisting in it. The aperture in the skull is filled up, either entirely or only in part, according as the pericranium and dura mater are injured, the age of the patient, and the size of the hole; plastic matter is thrown out, filling up the opening, which becomes cartilaginous, and in which granules of new osseous matter is deposited chiefly around the margin. The aperture never becomes perfectly firm and the same as the rest of the skull, whatever may be the age of the patients, and in some cases the opening requires to be protected by a piece of leather or some kind of elastic cap.

VII. Hernia Cerebri.

Hernia, or protrusion of the brain, takes place in cases of compound and comminuted fractures with laceration of the cerebral substance. It sometimes projects through the aperture, becomes strangulated, and sloughs, and generally terminates fatally from inflammation; or it may project and undergo the same process without, in some cases, any material derangement to the cerebral functions.

When a deficiency of the cranium exists, whether caused by the use of the trephine or not, precautions ought to be taken to prevent hernia of the brain by steady and uniform pressure, and by strict antiphlogistic measures. When a hernial protrusion has actually taken place, steady and firm compression and bandaging are the best means of cure.

When sloughing occurs it may, on some occasions, be admissible to use the knife, but escharotics should not be employed. The protruded part in true hernia of the brain is formed of disorganized cerebral substance mixed with blood and lymph. On some occasions a coagula projects, with a thin coating of brain, which resembles the true hernia cerebri.

Out of eleven cases recorded in the Museum Catalogue where the trephine was employed, seven were followed by hernia of the brain, and out of these seven, two recovered; as cases of fungus or hernia of the brain, see J. Evans, J. Collins, and T. Cain, at pages 16, 39, and 47, etc., and also the following.

No. 3481.—Drawing showing gunshot wound of the head.—It shows exceedingly well the appearance of a fungous tumour arising from the brain; it was cured by pressure in fifteen days. Private Thomas Deverill, æt. 24, 61st Regiment. Fracture of right parietal bone, with depression. Was hit with a musket ball on the 13th January, 1849, at Chillianwallah, which caused a small wound in the scalp and fracture of the right parietal bone near its anterior and inferior angle; the wound was dressed with adhesive plaster. 16th.—A T incision was made to see the state of the fracture and as a means of abstracting blood. ʒxvj were allowed to flow from the wound. The bone was found to be very much depressed and comminuted. About 4 o'clock, p.m., he was more drowsy, and on being roused he appeared morose, and complained of the same kind of pain and intolerance of light. The operation of trephining was had recourse to; the head of the trephine was placed more than half above the fracture, and a circular piece of bone was removed. The dura mater and middle meningeal artery were wounded by the depressed bone, and the artery poured out bright, scarlet-coloured blood in a continuous stream, ascending seven or eight inches; it was restrained by pressure of the fingers. Three loose portions of bone were taken away, and the depressed portion elevated to nearly the same level as the surrounding. The operation being finished, the meningeal artery was allowed to bleed to the extent of ʒxij. The lips of the wound were brought together, and slight pressure with a pad and bandage was used. He went to bed without assistance, and expressed himself free from pain or headache. 31st.—Within

the last two days a fungous tumour has sprung from the situation of the wound in the dura mater, and is now almost the size of a hazel-nut, of a bright, pink colour, and pulsating; it is diminished by pressure without causing any pain or uneasiness, but on pressure being removed, returns to its former size. 15th.—Wound healed; sent home for change of climate, as India would be too hot for a person who had lost such a large portion of bones of the head.

VIII. Abscesses of the Liver consequent on Gunshot Wounds of the Head.

Abscesses of the liver resulting from injuries of the cranium have been thought to be of frequent occurrence, more especially in those which suppurate than from simple concussion. Sometimes after a severe shock no abscess forms in the liver; at other times abscesses are found where no shock has been received. They are also occasionally observed in cases of diseased brain arising from other causes.

In many cases of injury of the cranium neither the liver nor any other organ sympathises; in others almost every organ suffers. There may be only slight pain in the region of the liver, torpor, or bilious diarrhœa, or some other evidence of functional disturbance, to the actual formation of abscesses in the liver; they are most frequently deep-seated, and of very large size; sometimes, however, they are superficial, and they may either point externally, or burst into the lung, stomach, or colon. The abscesses are of a very chronic character, and form without almost any general disturbance; at other times there are symptoms of acute inflammation. Injuries of the head very frequently occur to people under the influence of liquor and to those of intemperate habits generally, where the liver is otherwise disordered, and are thus rendered more susceptible to disease. On the other hand, they are observed in those of abstemious habits.

The stomach also suffers from sympathetic nervous influence, vomiting and irritability of the stomach being frequently observed where no diseased appearance is discoverable on dissection. The spleen is likewise disturbed by the shock in injuries of the head,

also the thoracic viscera; increased secretion taking place in the serous cavities, with the formation of abscesses in the structure of the different organs. Priapism and loss of the sexual powers has also been observed in injuries of the cranium.

IX. Treatment of Gunshot Injuries of the Head.

The treatment of concussion and compression has already been described.

All cases where inflammation of the brain or its membranes is to be dreaded after removing its cause, should be treated on the strictest antiphlogistic principle; bleeding from the arm, leeches to the head, opening the temporal artery or jugular vein, shaving the head, and applying ice or other cold lotion, such as this,—composed of 4 ozs. of nitrate of potash, 2 ozs. of muriate of ammonia, 1 pint of vinegar, and 10 pints of water. With regard to the mode of dressing in gunshot wounds of the head, a piece of fine wet linen is first applied, which adheres to the wound, and should not be frequently removed. Over this Stromeyer recommends that a net, made for the purpose, should be placed, so as to retain the dressing, and the cold applications are to be made through the net. Patients labouring under wounds of the head are frequently so restless that the wet lint is quickly tossed off, so that the suggestion of Stromeyer appears to be worthy of being generally adopted. Internally purgatives, calomel until it begins to affect the mouth, given in two-grain doses every four or five hours according to circumstances, and mercurial ointment rubbed into the thighs so as quickly to affect the system; at a late period blisters to the head or to the nape of the neck, and also a seton, should be the means employed, according as the case may require.

CHAPTER III.

WOUNDS OF THE FACE.

I. Simple Flesh Contusions and Wounds.

In cases of incised wounds of the face, one of the chief objects is to prevent scars. After the wound has been cleaned, the edges should be brought in apposition by the twisted suture upon thin harelip pins, or the interrupted suture, are the best modes of dressing. When in the neighbourhood of the eyelids, the interrupted suture or merely court plaster should be employed, as the twisted suture cannot be used in consequence of the mobility and the receding of the eyelids behind the margin of the orbit, and also from its causing irritation to the eye itself; as cicatrization takes place, eversion of the eyelids must be guarded against. In wounds of the face there is generally considerable bleeding, which, in some cases, may require the application of a ligature, or when in the lips, harelip pins may be inserted. When the wound is perpendicular, the parotid duct and branches of the portio dura may be divided, in the one case leading to a salivary fistula, and in the other to paralysis of one side of the face. In a fistulous opening in the cheek, the margin should be brought together and pressure applied. When the aperture into the mouth has closed in a case of salivary fistula of some standing, it may be necessary to make a fresh opening into the mouth, so as to allow of the secretion from the parotid to flow into the mouth, and then to endeavour to close the external aperture. The margins of the aperture are often hard and indurated, requiring to be excised before union can be effected.

II. Penetrating, Perforating, or Lacerating the Bony Structure, without Lesion of important Organs.

Gunshot wounds of the face are frequently of a serious nature, and tedious in cure, producing fractures of the various bones, the ball being impacted in the nostril or antrum, so as to resist every attempt at immediate removal, until, after months or years, it may have become loosened and drop down from its original position, by its own weight, on to the palate, and where it may be extracted through the mouth, as in the case from which preparation No. 2955 was taken. In such cases there are generally extensive caries and necrosis of portions of the bones in the track of the ball, with profuse and very fetid suppurative discharge, which continues to come away for a very long period, and is a source of great annoyance to the patient. Ball, or fragments of shell and spicula of bone, should at once be removed, if this can be effected, and by the mouth, so as to avoid any unnecessary scar on the face. When the alveolar processes are broken, and the teeth completely loosened, or exfoliation of portions of the bone takes place, which frequently occurs in injuries to the jaw, they must be extracted as soon as possible. No. 2955.—Cast of the breach and screw of a fowling-piece, which lodged in the forehead and nasal cavities. From an officer, who lived seven years after the accident. The anterior portion of the right hemisphere of the brain rested on the flat part of the breech, and was separated only from it by a false membrane.

Six cases were admitted from India, of which four were discharged to duty and two invalided.

III. Penetrating, Perforating, or Lacerating the Bony Structures with Lesion of the Eye, &c.

Wounds of the orbit are always very dangerous, on account of the close proximity of the brain. Occasionally a musket ball enters the orbit without wounding the eyeball; still, total loss of vision is frequently the result, which may

either be caused by a wound of the optic nerve, or some of the branches of the fifth pair by sympathy.

Injuries of the eyeball are frequent in military practice, from gunshot, shell, splinters, and explosions of gunpowder, &c. Weakness of vision, blindness, or amaurosis, often result from injury or contusion of the parts around the eye, and especially when the eye itself is hurt. When the concussion produces rupture of the retina, or displacement of the crystalline lens, extravasation takes place into the eye, followed by great pain in the ball itself, and likewise around the orbit, with acute inflammation, and occasionally permanent amaurosis, or complete disorganization of the eyeball.

When the eyeball is wounded so that the humours escape, and the iris protrudes, very violent inflammation of all the structure frequently ensues, causing total loss of vision; or, if the inflammatory symptoms have been subdued, still, opacity of the cornea, or adhesion of the iris, with closing of the pupil, may follow.

The *treatment* in all severe wounds of the eye is antiphlogistic; when there is any tendency to the effusion of lymph in the eye, careful administration of calomel and opium ought to be employed. Should the iris protrude, it ought to be returned if possible, or cut off with a pair of scissors, and the applications usually employed in disease of the eyes are to be adopted.

Wounds of the ear are not of frequent occurrence, and are to be treated on the same principle as those of the scalp; the detached piece, when resulting from a sabre cut, is to be replaced and retained in its place by the interrupted suture.

Gunshot wounds of the mastoid process, or neighbourhood of the ear, generally produce deafness, suppuration, and caries of auditory canal, with loss of the small bones, or paralysis of this side of the face from injury to the portio dura; or the inflammation may extend to the brain and cause death. Deafness to a greater or less extent occasionally takes place from a ball having passed close to the ear. The mastoid process may be fractured, and there may be great depression externally without any corresponding injury to the internal table of the skull, on account of the large mastoid cell intervening between the two tables of the skull.

12 were admitted from India with lesion of the eye, of which 3 were sent to duty and 9 invalided; 1 was a case of total loss of vision of both eyes; 8 had lost the right eye, and 3 the left; 7 were supplied with artificial eyes. The 3 sent to duty had lost the right eye, and had artificial eyes supplied to them. The injury to the eyes was caused by musket ball in 8 instances, in 2 by a piece of shell, and in 2 by small shot. The musket ball generally entered the temples, passed in a slanting direction, and made its exit through the eye.

The men supplied with artificial eyes were very much improved in appearance; and the different shades of colours of the iris and sclerotic were so well matched that it was almost impossible to tell the natural from the artificial one: so much was this the case, that the officers, on going down the ranks, were puzzled to know the one from the other; one man, in a drunken spree, had his eye broken to pieces, fortunately for him, without any injury from the broken portions of the artificial eye.

84th Regiment.—Private Francis Lyons,* wounded, September 25th, 1857, by a musket ball, which entered the left temple in front of the ear, and passed out through the eye; two pieces of bone were taken away, two hours after, from the aperture of entrance of the ball. January 11th.—The sight of the eye is now entirely destroyed; the eyelid remains entire; there is a hollow in the left temple from the loss of bone and muscle; the wounds are healed; complains of pain in the head. Remains undisposed of.

93rd Regiment.—Private Christopher Porter,* wounded November 16th, 1857, at Lucknow, by a small rifle ball, which entered the left orbit at the side of the nose, and passed across the right orbit, and out about the centre of the right zygoma, destroying the sight of both eyes. The scar of entrance of the ball cannot be detected, but that of exit is evident; there was considerable hæmorrhage from the wound. June 11th.—The globes of the eyes were collapsed, and the humours escaped; he has frequently very severe pain in the head, and cannot stand exposure to the sun, or excitement of any kind.

64th Regiment.—Private Michael Kirwan, wounded August

* The cases of Lyons and Porter are mentioned by Assistant-Surgeon Chaumont 1st Battalion of Rifles, in the 'Edinburgh Monthly Journal' for December, 1858.

5th, 1857, in Oude, with General Havelock's force, by a piece of shell which struck him on the right side of the head, producing total loss of vision of right eye. The eyeball is collapsed, but the lids remain; the left appears as if threatened with amaurosis from nervous influence, owing to the injury of the right eye; during the slightest exercise or exposure to the sun, he suffers from giddiness and dimness of vision, which compels him to remain quiet. Remains undisposed of.

90th Regiment.—Thomas Gallagher, wounded at Lucknow, November 16th, 1857, by a musket ball, which entered in front of the right ear, and passed out under the eye of the same side, close to the nose. One piece of bone came away from the entrance of the ball. July 13th.—Wound healed; cannot open his mouth to any extent, and has lost the sight of the right eye; the pupil of left is very much dilated, and the eye has an amaurotic appearance, but the ball of the eye is uninjured.

60th Regiment.—Corporal John Jackson, wounded at Delhi, August 2nd, 1857, by a musket ball in right eye, which took an unascertained course; there was not much loss of blood, and he was for about five weeks in nearly an unconscious state. July 20th.—Has lost the use of right eye, the humours having escaped; lids not much injured; has occasional headache, and has lost the sense of smell; is otherwise in good health. Was supplied with a glass eye. 21st, 1858.—Duty.

IV. Fracture of the Lower Jaw.

It is worthy of remark, the frequency of *ununited* fracture of the lower jaw in cases of gunshot injury. In fracture of the lower jaw the mouth is to be closed, so that the upper jaw may act as a splint, and a proper bandage applied, and the patient supported on fluid food. The teeth are sometimes driven into the soft parts, or cause severe wounds of the cheek. The deformity resulting from gunshot wounds of the jaw should be handed over to the dentist, for the application of his skill and art. There are several casts of cases in the Museum at Netly which were very much benefited by the assistance of dental

surgery. In some cases the whole of the lower jaw is carried away, and still the patient may survive, but death more generally is the result.

This bone is well supplied with blood, so that necrosis to any great extent does not generally follow severe comminution; still, callus is not thrown out so copiously for the repair of fracture as in the long bones of the extremities. Ununited fracture of the lower jaw does not seem to have been of such frequent occurrence amongst the wounded from the Crimea as those from India.

Eight were admitted from India with fracture of the lower jaw. Of these, five were invalided, two sent to duty, and one to modified duty. Of these eight cases, three were instances where the fracture still remained ununited, although the fractured ends of the bone were in contact. In one case the ball struck one side of the lower jaw, and was cut out on the opposite side, one month after, fracturing the bone on both sides. In one the ball was cut out from below the tongue. In one case, from a shell wound, there was a double fracture; one on the right side of ramus, and also another, near the symphysis, with great laceration of soft parts and deformity resulting; the first-named fracture remained ununited. In another case there was a double fracture from a musket ball; the fracture at the entrance of the ball still remained ununited; that at exit had become united. In one case, from round shot, the whole of the left ramus of the lower jaw had been extracted at the time, or came away by exfoliation, leaving a large chasm and great deformity on this side of the cheek, from laceration of the soft parts. In one case there was a fracture on the left side, at the angle of the jaw, still ununited.

Attempts were made to excite action in the ends of the bone by forcible rubbing together, and afterwards keeping the two fractured ends at rest by wire round the teeth, and a piece of cork placed between the teeth of the posterior fragment and that of the upper jaw, but without success. It was not thought advisable to try the effects of a seton or other means of inducing the effusion of new bone.

93rd Regiment.—Private William Jeffreyes, wounded at Cawnpore, December 1st, 1857, by a piece of shell on the right

side of the body of the lower jaw. The soft parts were much torn, and the lower edge of the body of the bone was broken to pieces. There was also a vertical fracture of the bone near the symphysis. July 12th, 1858.—The first-named fracture is still ununited, and quite movable, and there is a large scar on the chin, opposite to it. There does not appear to be any necrosed pieces of bone coming away; the second fracture has united. August 15th.—Invalided.

8th Regiment.—Private Edward Sweeny, æt. 26, wounded at Delhi, September 14th, 1857, by a musket ball, which entered at the left side of the face, fracturing the lower jaw opposite to the first molar tooth, and passed across to a corresponding part on the opposite side of the lower jaw, where it made its exit. The portion of the symphysis of the lower jaw in front was, for about three months, quite loose and detached; several pieces of bone came away from the fracture on the left side; none came away from that on the right side, which became united in about three months after. August 2nd.—The fracture on the left side of the lower jaw still remains ununited and quite movable, but there is no discharge from it; he cannot open his mouth, and his chin is distorted. August 16th.—Invalided.

20th Regiment.—Enoch Pinder, æt. 22, wounded at Sultanpore, February 23rd, 1858, by a round shot, on the left side of the lower jaw, fracturing this bone; nearly the whole of the left ramus of the lower jaw had been extracted at the time, or came away by exfoliation; the left shoulder-joint was also wounded by the firelock. September 26th.—Wound still discharging from a small sinus, and there is a large cicatrix on this side of the face, which shows a deep hollow from the loss of bone. A dentist has made an artificial appliance, with several teeth attached, which fills up the deficient space in the left side of the jaw, and the patient feels considerable advantage from it. November 3rd.—Invalided.

23rd Regiment.—Private James Morgan, wounded at Lucknow, March 16th, 1858, by a musket ball, which fractured the left ramus of the lower jaw at its angle; where the ball was extracted, several large pieces of bone have come away. September 26th.—Wounds healed; fracture still ununited. 27th.—Duty.

Sergeant Joseph Cherry, æt. 32, wounded by a grape shot at

Mujudior, October 27th, 1858, which entered over right malar bone, and made exit through the mouth, lacerating its left angle and carrying away the greater portion of the right superior maxillary bone, fractured the right zygoma, displaced the right malar bone, and fractured also left superior maxillary and left ramus of lower jaw. The left superior maxilla has been allowed to get into the middle of the mouth, so that its teeth come against the centre of the tongue. The fracture of the lower jaw is pretty well united, but of course the jaw cannot be brought into apposition. Invalided.

CHAPTER IV.

GUNSHOT WOUNDS OF THE NECK.

Wounds of the neck inflicted by a sword or any sharp-cutting instrument are very rapidly fatal, from division of some of the great vessels. The first point to be attended to is to arrest the bleeding from both arteries and veins by the application of ligatures and pressure, bringing the lips of the wound properly together.

It is remarkable that the large arteries and veins in the neck should escape injury so frequently in gunshot wounds. This may, in some measure, be accounted for by the structures in this region being so loose and movable that they yield or recede before any projectile.

Eight cases were admitted, and eight were discharged to duty. In one the ball entered close to the thyroid cartilage on the left side, and still remains in, but its position could not be ascertained with certainty. One was a flesh wound on the right of the larynx; ball dropped out. In another case the ball entered external to the right sterno-mastoid, and passed out at the margin of the trapezius, without injuring an important vessel or nerve.

78th Regiment.— Private Benjamin Ritchie, wounded at Lucknow, September 25th, 1857, by a musket ball, in the left side of the neck, close to the thyroid cartilage; the ball still remains in, but its position cannot be ascertained with certainty. He spat up blood for some time after. June 11th, 1858.—He cannot move his head except to a small extent laterally, and keeps his head bent down upon the chest. In consequence of this constrained position, the spinous processes of the fifth and sixth cervical vertebræ project. 17th.—At Fort Pitt, under the supposition that the ball might possibly be lying imbedded in this

process, an incision was made downwards to the spinous processes, but no metallic substance could be detected. August 30th.—Duty.

No. 2915.—Preparation of the atlas and axis, showing fractures of the anterior arch of the former, from a gunshot wound. From Private F. Boyle, 12th Regiment. Received a gunshot wound on the 3rd December, 1854, in an attack made on a stockade erected by a body of gold-diggers on the gold field of Ballarat, for the purpose of resisting the constituted authorities. The ball entered the left side of the nose superiorly, and passing downwards and backwards, came into contact with the atlas, producing a comminuted fracture of the bone anteriorly, and a simple fracture posteriorly, and displacing to a considerable extent the fragment of the bone. A very short time after receiving the above wound a clumsily formed conical bullet was discharged by the mouth, and, some days afterwards, the man complained of severe pain behind the jaw on the right side, and directed attention to a hard body in the vicinity, which, he conjectured, must have been either a second bullet or the cap of the one voided, and he wished to have it removed. It was only after death that the supposed foreign body was found to be the transverse process of the atlas. Considering the nature of the injury, it is a matter of surprise that the man should have lived thirty days after receiving it. It is evident that an incautious movement of the head might at any time have terminated life by causing greater displacement of the bones and so compressing the spinal marrow. He died on the 12th January, 1855.

CHAPTER V.

GUNSHOT WOUNDS OF THE CHEST.

Simple flesh contusions or wounds from gunshot, bayonet, or sabre, &c., demand peculiar attention, only from the danger of inflammation being set up in the contained organs.

In some cases there is an injury of the bony or cartilaginous parietes without lesion of contents. A ball may strike the ribs and pass out a little posterior to the entrance; the patient may spit up blood at the time, or even afterwards; or the bone may become necrosed, and still the lung or pleura may not be directly injured, and these patients generally recover.

A ball sometimes runs round under the skin, leaving a dark, livid appearance along its track in the muscles or even between the ribs, and makes its exit on the opposite side, and where, to all appearance, it has gone right through the lung, and bloody sputa still further confirms this opinion.

Sometimes a ball strikes against the coat or shirt, and is withdrawn unperceived, and may thus be mistaken for a case of penetrating wound and the ball lodged.

In some cases of gunshot wounds penetrating the chest the ball is lodged, or apparently lodged. There are cases on record where balls and other extraneous bodies have been lodged in the lung, or lying loose in the cavity of the chest for years, without causing any serious disturbance to the patient; still this is far from the usual result, as death generally ensues unless the foreign body is removed, and when it does lodge, a cyst is formed by adhesive inflammation, and thus shuts it out from the rest of the system. A ball, a piece of cloth, or any other foreign substance which has been driven into the cavity of the pleura, generally gives rise to inflammation and suppuration, and ultimately death, unless removed by operation. A

ball rolling about in the chest and on the diaphragm can be ascertained (as also the presence of fluid) by percussion and auscultation, and decides the place where the opening into the chest should be made, which is generally between the eleventh and twelfth ribs, unless the original wound is in a dependent position, when it should be reopened.

In perforating gunshot wounds of the chest, the wound may or may not bleed, and there may be only slight expectoration. Although the presence of blood in the expectoration may be looked upon as pretty sure evidence of injury to the lung, still its absence is no proof that the lung has not been wounded; respiration may be difficult, extremities cold, pulse weak, and countenance pale, but much depends upon the extent or nature of the injury and the peculiar constitution of the patient.

When the wound is too small to admit of examination by the finger, it ought to be enlarged, so that the surgeon may ascertain whether the ribs have been injured, or whether any extraneous matter is lodged. The splintered portions of the rib and any foreign body should be removed, and the sharp ends of the fractured ribs rounded off, but all unnecessary probing should be avoided.

Wounds of the lung become more dangerous as they approach the root, on account of the vessels being larger. The bruised and lacerated tract of the ball bleeds more or less according to the size of the vessel injured. Generally, more or less blood is spit up, and when it is effused into the cavity of the chest it gravitates to the posterior part, or on to the diaphragm, according to the position of the patient. When the wound is closed and the effused blood accumulates, the lung becomes gradually compressed, until the hæmorrhage ceases from the pressure. Should the effusion take place to such an extent as to endanger life from asphyxia, the wound should be reopened or the chest should be punctured with a trochar.

When it becomes necessary to make an *opening into the cavity of the chest for the evacuation of blood, purulent fluid, or air, the operation can be performed as follows*:—The patient having been placed in a sitting position and the chest supported, an incision should be made, commencing about two inches from the spinous processes of the vertebræ, over the intercostal

space, between the eleventh and twelfth ribs, and continued obliquely downwards and outwards between them. The latissimus dorsi and serratus having been divided, the external and internal intercostal muscles are to be divided in the middle of the intercostal space, and the pleura exposed, when, if the cavity contains fluid, it will project between the ribs so as to be felt by the finger. An opening is to be made close to the margin of the mass of spinal muscles at the moment of inspiration. The opening can be enlarged, if necessary, by the introduction of a director during full inspiration. The diaphragm ascends as high as the sixth rib in full expiration, and might easily be wounded if this precaution was not adopted.

Emphysema.—Fracture of the rib, which has inflicted a wound of the surface of the lung, is the most common cause of emphysema, and through the aperture thus made the air escapes into the pleural cavity, and also into the subcutaneous cellular tissue. It is seldom that emphysema follows a gunshot wound, but is somewhat more common immediately after sword or lance wounds, but not so frequent as was formerly supposed. When air is admitted into the cavity of the chest, the lung does not collapse to any great extent, but continues to do its duty, although rather imperfectly, and also in those cases where a ball passes directly through the substance of the lung. The lung can only be compressed by a fluid, as in empyema, pneumothorax, or by confined air. In some cases the patient cannot lie down, and appears to be on the point of suffocation, the face and lips purple, &c. An opening should at once be made into the chest, for the purpose of evacuating the compressed air or fluid, as the case may be. Percussion and auscultation is of great service in diagnosing these cases. When partial or general emphysema takes place, incisions should be made into the subcutaneous cellular tissue on different parts of the body.

It is seldom that a HERNIA of the lung takes place after a gunshot wound. When a portion does protrude and is left uncovered, it soon becomes livid and shrivelled, without being gangrenous, and may be removed by the knife. Hernia of a portion of the lung is most likely to occur during expiration,

and when the wound is of considerable size and has been left open. The protruded portion should be returned and covered by the integuments, sutures inserted, and a pad and bandage applied if necessary.

When death takes place shortly after the receipt of the wound, the portion of lung immediately in close contact to the tract of the ball will be inflamed and consolidated. When, after the lapse of several years, at the entrance and exit of the ball, there will, in all probability, be pleuritic adhesions, with depressed and adherent cicatrices, and along the course of the ball there will be a firm, consolidated fibrinous substance, distinctly marking the course of the ball, or a narrow, thin line may be the only evidence to show that the lung was wounded.

A ball in passing through the substance of the lung destroys the life of the part, which suppurates, and either gradually heals, leaving a depressed cicatrix, usually, although not always, attached to the walls of the chest. During life, in many cases, it interferes so little with the respiratory murmur as not to be noticed by auscultation, as was very clearly observed in several of the cases from India. On other occasions the wound does not heal, nor the track of the ball close up, but remains open and fistulous, and becomes lined by a distinct membrane, as can be seen in preparation No. 3638. (See Plate II, fig. 1.)

The two cases from India which terminated fatally, viz., Doyle and Knox, particularly that of Doyle, is interesting, as furnishing an admirable illustration of a perforating gunshot wound through the lung, the track of the ball still remaining open and fistulous, and being lined by a distinct, firm, false membrane, having numerous bronchial tubes of moderate size entering it; it also shows gangrene taking place in the healthy lung, and the wounded one remaining almost perfectly free from disease.

It is stated in the Report on the Wounded from the Crimea, vol. ii, p. 321 :—"Occasionally small circumscribed collections of pus took place in the track of the ball, surrounded and cut off from the remainder of the lung by consolidated pulmonary tissue, but in no case did the wounds of the organs remain a fistulous passage."

It is a point well worthy of remark, that although, from the

position of the apertures of entrance and exit of the old round ball, it often appears as if it must have gone through the centre of the lung, still it will be found that the lung is only wounded superficially, or not through the thickest part, as is seen in the case of Doyle. This seems to be produced by the direction of the ball being deflected by striking the ribs, and then making its exit directly opposite. If a knife or piece of wire were put from one aperture to another, it would, in this case, pass directly through the thickest part of the lung. Preparations Nos. 3637, 3638, 3639, page 86, are from Private Owen Doyle.

Frequently very severe wounds are inflicted on the upper and back part of the chest without any injury to the contents, producing great laceration of the muscles, with splintered fracture of the scapula, followed by sloughing, with tedious, deep-seated suppuration and hectic, occasionally terminating fatally, and leading to secondary affections of the lungs.

The *diagnosis* of wounds of the lung in gunshot injuries is frequently very difficult, and none of the ordinary signs singly can be exclusively relied on, but taken collectively, we can, in most cases, come to a correct diagnosis. The symptoms indicating a wound of the lung are hæmoptysis, dyspnœa; the passage of air by the wound or tromatapnœa, emphysema, pneumonia, and pleuritis; also the supposed course or direction of the ball can, in many cases, assist us in coming to a conclusion as to whether the lung is really wounded or not. When the lung is injured, florid blood oozes from the external wound, and frothy, arterial blood is expectorated or brought up by coughing; the pulse is weak and fluttering, nostrils distended, and eyes staring, and extremities cold.

Treatment.—In wounds of the lung the first dangerous effects are exhaustion from hæmorrhage, or suffocation from blood being poured into the air-cells or cavity of the chest. The secondary affections to be dreaded are violent inflammation of the pleura or lungs, or both combined, with long, tedious suppuration, causing cough, emaciation, and hectic, which frequently leads to a fatal termination.

When the contents of the chest have sustained a lesion by contusion from round shot, which has fractured the ribs, but without penetrating or causing any external wound, the case

requires to be treated on the usual principles of surgery, viz., strict antiphlogistic measures, rest, and cold-water dressing where circumstances demand it. A firm elastic bandage should be applied to the chest, so as to restrain the motion of the ribs and to cause the patient to perform respiration as much as possible by the diaphragm, and strict watch kept for the supervention of pneumonia or pleuritis.

Incised wounds of the chest should be closed by sutures, and a compress and bandage applied. When there is much hæmorrhage from a small wound it ought to be enlarged, and if a bleeding vessel can be detected external to the cavity, it ought to be secured by a ligature. Should the blood be found to come from the inside of the chest, it should generally be closed as soon as possible, although in many cases the loss of a considerable quantity of blood is rather advantageous than otherwise. When blood has been effused into the cavity of the chest, the wound may be left open for a few hours, or even reopened after a longer period, for its evacuation, and afterwards closed should symptoms of difficulty of breathing and approaching suffocation show themselves.

During the state of shock a little cordial should be administered, and the patient enjoined to remain perfectly quiet. According as reaction takes place, the general, and especially the local symptoms ought to be watched, viz., for inflammation of the lungs and pleura.

Copious and indiscriminate bloodletting was formerly recommended in such injuries, but is now seldom followed. Many cases, where there can be no doubt of the lung being wounded, have recovered without bleeding, and in other cases the distressing symptoms have been little alleviated, or the fatal termination averted by copious bleeding. The surgeon must use his discretion as to the necessity of venesection, and the amount in each case. By this it is not meant to dissuade entirely from venesection in wounds of the lung, but merely to state that because the lung has been wounded, the patient need not, as a matter of necessity, be bled to syncopy, and that repeatedly. Pneumonia to any great extent does not usually follow gunshot wounds of the lung, and that only along the tract of the ball, but it appears as if the amount of pneumonic

inflammation was only such as to be sufficient and necessary for its closure, and that if bleeding would affect it at all, it would act injuriously.

In most cases of gunshot and sabre wounds of the thorax, when the first seventy-two hours have passed, great hopes may be entertained of the patient's ultimate recovery. Hæmoptysis is most to be dreaded during the first forty-eight hours, and if within moderate bounds, it is rather advantageous to the patient than otherwise. Hæmoptysis at a later period is liable to recur at any time, but generally ceases of its own accord, or after the administration of some astringent medicine. Digitalis and opium may, in some cases, be of service in relieving the pain and spasmodic cough.

Patients after having been cured of a gunshot wound generally complain of dyspnœa, tightness across the chest, especially on walking up a hill, and the lungs and pleura are generally ever after very prone to disease, and are liable to be affected by the slightest atmospheric changes, although the reverse has been in some cases observed to take place. Many cases, however, recover so completely from penetrating gunshot wounds of the lung, that no abnormal sound can be detected along the course of the ball, and the patients find themselves so perfectly well that they have continued to do their duty for years as soldiers, as seen in some of those from India.

Twelve perforating gunshot wounds of the chest arrived from India, of which 6 have been sent to duty; 2 to modified duty; 2 invalided; and 2 died. Seven were wounded on the right side of the chest, and 2 on the left; in 4 instances it is mentioned that air passed out of the wounds of the chest. Eight were wounded by musket ball, and 1 by grape shot.

In all these cases there can be little doubt of the lung having been wounded, with, perhaps, the exception of Knox and Farrell. It is also remarkable that so many as six had so far perfectly recovered as to be able to return to duty, and the lung to have been so completely restored that nothing abnormal could be detected, either by percussion or auscultation, along the course of the ball, although it is to be supposed inflammation of the lung and pleural cavity took place to a greater or less extent in all. It is, however, stated that pneu-

monia occurred only in four instances; in one case there was hernia of the lung.

Out of 106 cases of this description of wound that occurred in the Crimea from the 1st April, 1855, to the end of the war, 82 died, and 24 were invalided or transferred, but it is not stated how many returned to duty. There are, however, the cases of one officer and one soldier detailed of recovery from this injury, and where the lung had perfectly regained its normal functions, one (the officer) returned to duty.

The wounds in all these cases from India were healed, with the exception of three, viz., in that of Doyle, Knox, and Moore. The case of Greenfield is interesting, as showing not only a wound of the lung, but also of the œsophagus, recovering and returning to duty.

Private Walter Knox died at Gravesend of phthisis, and an extensive abscess was found extending from the wound near the right nipple to the crest of the ilium, with protrusion of the fractured ends of the ribs. The medical officer who made the post-mortem examination states that there was no communication between the cavity of the thorax and the wound; and that there was no cicatrix nor trace of injury to the lung in the position of the wound. But it appears that as the fractured ends of the ribs and the points of the false ribs protruded from the wound, the pleura and lung itself could hardly have escaped injury. This case might, perhaps, have been more properly placed under Division 2, but, on account of the probable lesion of the lung by the fractured ribs, and also from the difficulty of tracing the course of the ball, the lung being studded with tubercles, &c., it was thought better to be classed under Division 4.

34th Regiment.—Private George Bateman, æt. 23, wounded at Cawnpore, November 30th, 1857, by a musket ball, which entered between the seventh and eighth ribs, immediately beneath the right axilla, passed inwards, downwards, and backwards, and made its exit between the eighth and ninth ribs posteriorly, about two inches from the spine. On admission he complained of great pain in the direction of the wound; there was considerable dyspnœa and cough, with bloody expectoration. On the 30th he had an attack of pneumonia. December

17th.—Was free from any bad symptoms. July 13th, 1858.—Wounds healed, percussion clear, and respiratory murmur distinct and clear all over the right side of the chest. July 14th.—Duty.

93rd Regiment.—David M'Kay, æt. 25, wounded at Lucknow, November 16, 1857, by a musket ball penetrating the right side of chest, emerging at the centre of the back, about an inch above the level of the lower angle of the scapula. During the progress of the case a piece of the spinous process came away; and during a full inspiration air came through the posterior wound with a loud report. July 14th, 1858.—Wound healed; respiration audible; pain in right side when lying down, otherwise quite well. July.—Duty.

60th Regiment.—Private John Peake, æt. 23, wounded at Delhi, September 14th, 1857, by a musket ball, which penetrated the body on the right side, about an inch from and in a line with the ensiform cartilage, wounding the organs within, and passing with slight obliquity downwards to the left side, to the ninth and tenth ribs, where it issued, and a piece of lung protruded; the wounds did not heal for five months; had vomiting of blood after the accident, and was insensible. July 20th, 1858.—Wounds healed, and feels quite well; at the exit of ball there is a small nipple-like swelling protruding between the ribs, probably a portion of consolidated lung. July 22nd.—Invalided.

75th Regiment.—Private Charles Greenfield, æt. 25, wounded at Delhi, June 15th, 1857, by a grape shot, weight four ounces, on the left side of the chest. The ball entered through the anterior fold of the axilla, and passed downwards, backwards, and inwards, in a slanting direction, through the left lung, and made its exit apparently between the ninth and tenth ribs, close to the spinous process of the tenth vertebra. The entrance aperture soon healed; that of exit did not heal for seven months, and for six or seven days portions of his food passed through it, and air from the lung. April 12th, 1858.—The external wounds have healed, but he suffers much from pain in the side, with a little cough, and much purulent expectoration. On examination there is dulness on percussion. and occasionally moist râles, but these have existed for some time, and are

gradually diminishing. The pain is evidently muscular, and has been treated as such with relief. 27th.—On examining his lung there is still at the spot above noticed the same dulness on percussion, with harsh respiration and increase of the vocal resonance. He is free from cough, and the position of the physical signs just mentioned corresponds with the course of the shot through his lung; their disappearance cannot for the present be looked for. 30th.—Had an attack of pneumonia of the lower lobe of the left lung, with cough, and rust-coloured sputa. June 1st.—He vomited from the effects of antimony which he was taking. This is worthy of notice, on account of the œsophagus having been wounded. 2nd.—A few moist râle could be heard. 5th. — Quite well. July 20th.—Wounds healed; complains of some difficulty of breathing. August 26th. —Modified duty.

Private Owen Doyle, æt. 24; total service four years and five months, of which he was four months in Malta, one year in the Crimea, and the remainder in India. Wounded at Cawnpore, November 26th, 1857, by a musket ball, which entered the right side of the chest four inches to the outer side of right nipple, between the sixth and seventh ribs, about two inches under the right axilla, and passed inwards and backwards between the tenth and eleventh ribs posteriorly, where it lodged under the skin and muscles about two inches from the spinous processes of the vertebra, where it was cut down upon and removed. The ball, on entering the chest, fractured the seventh rib, and on making its exit fractured the tenth rib. The usual symptoms attendant upon wounds of the lungs presented themselves. The man stated that air passed out of both wounds, and he spat up blood for a long time after. Soon after the wound he was attacked with pneumonia of the wounded lung, and for many days he suffered considerably. Ultimately all symptoms of this disease subsided. The wound healed, though he still suffered from cough, dyspnœa, and slight pain in the right side of the chest.* August 16th, 1858.—Admitted into Fort Pitt Hospital from India; wounds healed; complains of cough and shortness of breath. There was nothing abnormal to be de-

* This case is noticed by Assistant-Surgeon Chaumont, Rifles, in the 'Edinburgh Medical Journal' for December, 1858.

tected in the right lung, or along the supposed track of the ball. 18th.—Discharged to St. Mary's Barracks, to await invaliding documents. 31st.—Readmitted, complaining of pain in the chest generally, but more especially over the left side of the chest, and also slightly over the seat of the old wound; respiration hurried; expectoration abundant and muco-purulent; percussion clear over the right side of the chest; vocal resonance in the inferior lobe of the right lung, and along the track of the ball; dulness on percussion in left subclavicular region; respiratory murmur diminished, and crepitation distinctly audible; pulse strong, 86, and respiration 44 in the minute; cough very severe. Was cupped and blistered, and antimonials administered. September 8th.—The exit wound opened, and several small pieces of bone were taken away; complained of great pain, especially in the left side of the chest; pulse 80; respiration 28 per minute; wound discharging freely; healthy pus and air escaped on expiration and on coughing. 9th.—Felt very weak, and there was a very fœtid smell from his breath; expectoration very profuse and purulent, and of a disagreeable odour. These symptoms continued up to the 20th, when they began to improve, and he seemed somewhat better, and was able to get out of bed and go about, although still troubled with cough and purulent expectoration, and the discharge from the wound posteriorly had almost ceased. 27th.—Was feverish; pulse high; tongue coated; had a persistent pain in the left subclavicular region, and could not expectorate so freely as before. The fœtor of his breath and sputa returned as bad as ever, and the matter expectorated was of a thick, dark, stringy character. There was dulness on percussion over the whole of the left side of the chest. On the right side of the chest the percussion was clear, with only a few mucous râles, but the patient was in too exhausted a state to be accurately examined. All these symptoms continued much the same, and he gradually became weaker, and on the 9th October the discharge from the wound still remained very profuse and fetid, and air escaped freely from it on coughing. He gradually sank, and died on the 15th October, 1859, one year and eleven months after the wound.

Sectio Cadaveris, twenty hours after death.—*External appearances.* Body stout and well formed; rigor mortis not passed away; muscles generally firm, and of the usual healthy appearance. There is a cicatrix on the right side of the chest, four inches below and to the outer side of the right nipple, and there is a small depressed aperture on the posterior part of the right side of the chest, about two inches from the spinous processes of the vertebra, the integument around which is of a livid colour. *Cranium.*—About one ounce of fluid at the base of the brain; slight subarachnoid effusion; the veins of pia mater congested; structure was otherwise healthy; weight 3 lbs. 5 oz. *Thorax.*—The usual amount of serum in the pericardium; a fibrinous coagulum, not softened, in the right ventricle; the left side of the heart empty; structure of heart healthy; weight 12 oz. The *right lung* adhered firmly and universally to the walls of the chest by adhesions of old standing, more loosely along the anterior margin of the lung than posteriorly; structure of this lung perfectly healthy; crepitant, except a small portion of the inferior lobe close to the track of the ball, which will be more fully described afterwards. The left bronchus having been tied, on introducing the nozzle of a pair of bellows into the trachea, the right lung was found to expand perfectly, and air to rush out externally at the posterior aperture, or that of exit of the ball, showing that there was a free communication between the trachea and the wound in the chest. The aperture of entrance of the ball was marked by a cicatrix four inches below and to the outer side of the right nipple, where it entered the thorax, between the sixth and seventh ribs, and seems to have passed backwards, and made its exit between the tenth and eleventh ribs, and where the ball, as stated in the report, was cut down upon and removed soon after being wounded. On introducing a probe through the posterior or the exit aperture, it was found to proceed for one inch in the muscular substance external to the thorax, and then to enter the pleura, and to wound the lung superficially. From this a sinus extends for three inches forwards in the substance of the lung to the entrance aperture, now closed. This sinus is larger than a common quill, and is lined by a distinct membrane with bronchial tubes opening into it. The lung seems to have recovered from

the previous attacks of inflammation, except along the track of the ball, and where the bone had become necrosed, and kept the posterior wound open and discharging. The fractured ribs are united, and are not much displaced; that at the entrance of the ball projects somewhat inwards, and must have produced considerable irritation to the pleura and lung. (See Plate II, fig. 1, No. 3638.) Numerous pieces of necrosed bone were found in a paper under the patient's pillow after his death, which were supposed to have come from the ribs. The upper half of the *left lung* adhered to the walls of the chest by old adhesions; inferior lobe adhered to the thoracic parietes by lymph of a more recent date, a coating of which fringed it, and covered its lower margin: structure of the upper half of the superior lobe entirely destroyed and broken up, forming a large, irregular cavity, filled with a dark, fœtid fluid, having several of the larger bronchial tubes intersecting it, the whole in a state of gangrene; inferior half of the same lobe in a state of gray hepatization, as also the upper part of inferior lobe, which was condensed, and sank in water. (See Plate II, fig. 2, No. 3637.) The remainder of this lobe was œdematous, but otherwise free from disease. *Abdomen.*—Liver healthy; gall-bladder filled with dark bile; weight of liver 3 lbs. 8 oz.; spleen healthy. weight 11 oz.; kidneys healthy; weight of right, 8 oz.; left, 8½ oz.; stomach and intestines healthy; bladder empty and contracted; veins, as far as they could be traced, were found healthy, and the larger veins filled with dark coagula, and at parts fluid blood; but no fibrinous clots softened in their centres, nor pus globules, were detected. All the joints were healthy. This was at first thought to be a case of pyæmia, where the pus globules or blood-poisoning had excited inflammation in the left lung, resulting in pneumonia and gangrene; but, as stated above, none of the other morbid appearances usually found in cases of pyæmia could be discovered.

Our knowledge of all the circumstances connected with, and the pathological appearances resulting from poisoning of the blood in cases of open gunshot wounds, is not yet complete, so that this case, on more minute information on the subject, may be classed under the head of death from pyæmia, or perhaps it

Fig 1.

Fig 2.

Fig 1 a Track of ball b Lining membrane c Bronchial tubes. d Unhealed exit of ball.

is to be attributed to an accidental attack of pneumonia unconnected with the wound altogether. It is also remarkable that the inflammation should have attacked the sound lung, and not the one already in a state of disease.

In whatever manner the fatal result is to be explained, there can be little doubt that the wound in the chest influenced, in a most serious and baneful manner, the last fatal attack of pneumonia terminating in gangrene of the lung.*

78th Regiment.—Private Walter Knox, wounded at Lucknow, October 29th, 1857, by a musket ball, which struck him on the right side of the chest, near the nipple; the wound sloughed, and some pieces of bone exfoliated, leaving the respiration much impaired. The man stated that he was struck by a portion of shell, and that for three days after receiving the wound he expectorated blood. He was admitted into hospital at Gravesend from the ship "Argo" in the last stage of debility. A large abscess had formed, extending from the nipple to nearly the crest of the ilium, with numerous openings, through some of which the fractured ends of the broken ribs and the points of the false ribs protruded. On the *post-mortem examination* it was found that there was no cicatrix or trace of injury to the lung in the position of the wound, but that the lower and posterior portions of the right lung were a mass of disease, studded with tubercles in different stages, with several cavities, varying from the size of an acorn downwards. There was no communication between the cavity of the thorax and the wound, nor with the abdomen; but the peritoneum was generally much thickened with adhesions, and that portion corresponding with the seat of the abscess was almost of a cartilaginous texture, and divided by the knife with much difficulty. *Body* reduced to nearly a skeleton; the wound with the sinuses extended from the nipple to the crest of the ilium; the ribs on either side were detached from the lower portion of the sternum, and on the right side the fractured ends and also the points of the false ribs protruded through the skin. *Heart* large; pericardium contained

* It is to be regretted that there is no record of the early treatment in these cases of perforating gunshot wounds of the thorax, as to whether venesection was prevalent to a great, or only to a moderate extent. Still, I am inclined to think that it was not resorted to. In the case of O'Neill no venesection was employed.

about half an ounce of greenish, straw-coloured fluid; liver healthy; the gall-bladder was loaded with bile; intestines healthy.

14th Light Dragoons.—Private John O'Neill, æt. 29 years, wounded, November 23rd, 1857, at Mundesand in the Deccan, by a musket ball in the right side of the chest; the ball entered posteriorly at the inferior angle of the scapula, five inches above the spinous processes of the vertebræ, apparently between the eighth and ninth ribs, and was cut out immediately after from the right nipple. It had broken a rib at its exit. He went some distance on his horse from the field, and bled considerably; at the time his respiration was almost gasping, his countenance anxious, and pulse very feeble. He was almost in a state of collapse, and was thought to be dying. He was kept at perfect rest, his chest bandaged, and opium administered; for some days this treatment was continued; he was fed on barley-water; the pulse became rapid, and breathing painful; tongue dry and brown; thirst always urgent. On the 28th the wound began to discharge healthy pus; he had no cough, nor did he expectorate blood. The skin became cooler, and tongue began to clean, though the pulse continued frequent; the bowels had not been relieved since the wound had been received. 30th.—1 oz. of castor-oil relieved the bowels, and he was carried a march in a dooley, and took light puddings, milk, &c. On the 4th December, 3 oz. of port wine; no medicine. On the 9th could sit up for a few minutes to have his wounds dressed; they were both closing. The ends of the fractured ribs could be plainly felt; he was now allowed a little chicken diet. On the 15th the wound in the nipple had healed; he had gained strength, although he was very much prostrated. The chest did not act much on the right side during inspiration. On the 20th he could walk a little about the hospital; the posterior wound had nearly closed; there was slight crepitation about the lung near the wound, readily heard by the stethoscope; tongue had become quite clean; appetite good, and pulse natural. The chest was tender on pressure over the track of the ball, and he could not exert himself without a dull pricking pain there. The right side of the chest still acted very imperfectly. On the 5th September, 1858, the wounds healed; respiration at entrance and

exit of ball, and along supposed track through the lung, normal; and percussion clear. September 8th.—Duty.

90th Regiment.—Patrick Farrell, æt. 24, wounded, November 17th, 1857, at Lucknow, by a musket ball in the right side of the chest; the ball entered over the angle of the ninth rib of the right side, and passed out half an inch from the spinous process of last dorsal vertebra; several pieces of bone came away from the aperture of exit; he spat up blood at the time and also on several occasions afterwards. On the 10th October, 1858, the wounds healed. It is difficult to say whether the internal organs were wounded or not, and if so, whether it was the lung or liver; respiratory murmur and percussion on this side normal. October 15th.—Duty.

2nd Battalion Rifles.—Private William Moore, æt. 37, wounded at Cawnpore, November 28th, 1857, by a musket ball, which penetrated the left side of the chest, three inches below and a little to the left of the nipple, and came out at a corresponding point, behind where it injured the rib. The man states that wind came out of the wound, and that he spat blood. July 13th, 1858.—The anterior wound is healed; the posterior is still discharging, and a piece of diseased bone can be felt. September 30th.—Duty.

Private James Moore, 75th Regiment, æt. 23. Wounded on the 18th July, 1857, at Delhi, by a musket ball, which entered the thorax, one inch and a half below and a little internal to left mammilla, and after a course of seven inches made its exit behind. The lung seems to have been wounded, but not deeply; abscesses formed in the track of the wound, and many fragments of rib were subsequently extracted. The lung seems to work well; the wound is quite sound, but tender to the touch along the whole track; percussion in the immediate neighbourhood of the wound is dull, and the respiratory murmur not very audible. He is stout and in excellent health. Sent to modified duty.

Private J. White, 3rd B. Rifles, æt. 23. Was wounded 8th October, 1858, at Sandelah, by a musket ball, which entered four and a half inches above the nipple, and one and a half to the right of the middle line in front, and made exit behind, about centre of body of scapula, four inches to the right of the

spine, wounding the lung; both wounds are soundly healed. The ball at entrance seems to have gone between the ribs, but at exit a hole in the scapula can still be felt. Had been previously wounded in the Crimea by a musket ball in left shoulder, which seems to produce a partial fracture of left scapula. The right lung now (two years after the injury) works well, but that side of the chest is scarcely so much expanded as the opposite; there is no dulness on percussion. He was not bled locally or generally. Invalided.

CHAPTER VI.

GUNSHOT WOUNDS OF THE DIAPHRAGM.

In the Report on the Medical and Surgical History of the British Army in the Crimea, vol. ii, page 317, it is stated that "it occasionally happened that both chest and belly had been wounded." One case is detailed, that of Dolan; and another is mentioned to have occurred in the 4th Regiment. The first died on the tenth day, and the other sixteen hours after being wounded; but no case is recorded where a hernia of the abdominal organs had taken place into the pleural cavity. There appears to be a doubt as to whether Corporal Burke, 18th Regiment, was a case of rupture of the diaphragm without an external wound.

In the case of Greenfield, from India, there is every reason to suppose that the diaphragm was wounded on the *left* side, as the wound into the chest was so low that it was difficult to say whether the food passed out from the œsophagus or from the stomach just at its entrance. In Private Falloon's case it is probable that there was a wound of the diaphragm on the right side.

When the diaphragm is wounded, the floating viscera of the abdomen sometimes pass into the pleural cavity, and Mr. Guthrie is of opinion "these wounds never heal, but remain open ever after. When the diaphragm is wounded in the neighbourhood of the liver or spleen, adhesions may take place so as to prevent hernial protrusion."

It is always worthy of note, whether the wound is on the left or the right side, as to the probability of a hernia occurring, this being more liable to take place on the left than the right side.

There are three specimens of this rare and interesting descrip-

tion of wound in the Museum. In one case the soldier lived twenty-two years after, and did his duty; another lived one year, also in good health; and of the third there is no record.

No. 1260.—Diaphragmatic hernia; the greater part of the transverse arch of the colon, with the omentum, are situated above the diaphragm, and in the left pleural cavity. The opening is in the muscular portion of the diaphragm, and about an inch in diameter.

No. 1268.—Displays the whole of the stomach and greater part of the transverse arch of the colon (both rather small) with the omentum situated in the lower and anterior part of the left cavity of the thorax. The anterior surface of the stomach is firmly attached to the lower lobe of the lung; the lung at this side, as may be expected, has become much reduced in size, and occupies the superior and posterior part of its proper cavity. The right lung is smaller than the left, and from the circumstance of the heart being much displaced by the stomach and colon, and instead of extending across from the second rib of the right side to the sixth of the left, as this viscus naturally does, it now lies nearly parallel to the spine, having the apex almost on a level with the coronary ligament of the liver, and, being of a natural size, must have proved much less yielding during respiration than the stomach and the colon on the other side of the chest. The opening in the diaphragm extends in a transverse direction near to the centre of the dorsal attachment of the left side of this muscle, and the objects forming the hernia have contracted adhesions with the diaphragm and other parts, and the peritoneum lining the former is, in many places, continuous with that covering the colon. This very interesting specimen was taken from the body of Sergeant Denis Barry, 88th Regiment, who died on the 4th of January, 1833, in consequence of gangrene of the left lower extremity, produced, as it was supposed, by metastasis of a severe rheumatic affection of the larger joints. He was wounded at Fuentes D'Onores, in 1811, in the left breast; death took place twenty-two years after the wound. After receiving the wound he had never been able to wear his knapsack with ease, and his breathing became much affected whenever he walked quickly or ascended a hill.

No. 1269.—Diaphragmatic hernia, the result of a gunshot wound. The greater part of the stomach, the transverse arch of the colon, and omentum, are seen in the left pleural cavity. This lung adheres very firmly and closely to the walls of the chest, as low as the ninth ribs, by adhesions of long standing. The lung is pushed to the upper half of the cavity, but, on account of adhesions to the ribs, it is compressed into a thin layer, which lines the walls of the thorax. The heart is also displaced, and lies behind and a little to the right of the sternum. The large curvature of the stomach lies in front, and first showed itself on opening the chest. The transverse arch of the colon is to the left of the stomach, and between it and the ribs. The stomach reaches a little higher in the chest than the gut. There is an opening in the diaphragm, with rounded margins, two inches and a half in diameter, situated two inches to the left of the œsophagus; the peritoneum lining the diaphragm proceeds through the aperture, and is continuous with the pleura. Although the serous surface around the opening is smooth and uninterrupted, still there is some thickening, and an appearance of old cicatrization. In the pleural sac, close to the opening in the diaphragm, on its posterior and external margin, the stomach, colon, and omentum, adhere firmly to the pleura, covering the diaphragm and ribs to the extent of a few inches. There are also two broad, thin, and loose bands of adhesion, about eight inches in length, stretching from the omentum to the base of the pericardium. The stomach and colon are, however, loose and free in the pleural sac; the parts in the aperture of the diaphragm are free from adhesions, and not contracted, and the fingers were easily introduced through it, from the abdomen into the thorax. The œsophagus, after penetrating the diaphragm in the usual place, takes a sharp turn to the left side; the stomach then enters the thorax, a portion of the cardiac extremity of which still, however, lies in the abdomen, in front and to the right of the spleen; the larger part, having entered the chest, curves round and descends to the opening in the diaphragm. The pyloric orifice lies immediately in the aperture; about a foot and a half of the transverse arch of the colon, with the omentum attached, are also in this cavity. On the skin exactly opposite and corresponding to the diaphragm,

are two cicatrices in the left side of the chest, one situated between the eighth and ninth ribs, three and a half inches from their cartilages, where the musket ball had entered, and the other, its exit, between the eleventh and twelfth ribs, close to the transverse processes of the vertebræ. The ball, in its course through the thorax, must have wounded the diaphragm, and permitted the hernia of the stomach and colon. (See Plate III.) —*Donor*, Dr. Williamson, Staff-Surgeon. 31st Regiment.— Private Thomas Fletcher, æt. 40, an Irishman, a weaver, five feet six and a half inches; stout and healthy frame. Total service twenty years and five months, of which nineteen years and six months were spent in India, where he had two or three attacks of intermittent fever. He was wounded at Sobraon, February 10th, 1846, by a musket ball in the left side of the thorax, entering between the eighth and ninth ribs, and about four inches from their cartilages, and making its exit close to the transverse process of the eleventh dorsal vertebra, and between the eleventh and twelfth ribs. He landed in England on the 13th of January, 1847, in good general health. Admitted into Fort Pitt General Hospital on the 20th January, under observation for the wound in his side. Discharged well on the 2nd February. On the 11th February, immediately after his dinner, he was attacked with vomiting, and pain in the left side over the spleen; this continued until the evening of the 12th, when he was admitted into this hospital. He could not account for his sickness; he had been quite well in the morning, and his bowels had been acted on. On admission his skin was cold, pulse quick, small, and wiry, 90; respiration natural; pain over the spleen increased on pressure. On the 13th the pain had left the side and shifted to the shoulder and clavicle. It was not acute. He was free from all other pain and all inflammatory symptoms to the hour of his death, neither was there any pain on pressure in the region of the stomach, nor any tension of the belly, but, on the contrary, an extraordinary hollowness, or drawing in about the umbilicus, resembling very much in appearance a man suffering from "Asiatic cholera." His bowels could not be acted on, and the irritability of his stomach and vomiting of all things swallowed continued to the last. He began to sink in

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a Stomach, Colon & Omentum in the left side of the Chest. b Lung compressed. c Heart. &
ardium. d Diaphragm. e Aperture in Diaphragm. f Œsophagus & portion of Stomach. g Small & large intestine

J. Ford

W. Rose. sc

the afternoon of the 16th, gradually became weaker, and died on the 18th February, it being eight days from the time he was first attacked with vomiting, and twelve months from the time he was wounded. The *treatment* consisted first of an emetic, with a blister over the spleen. Afterwards full doses of calomel and opium, morphia, and hydrocyanic acid, frequently repeated, castor-oil combined with croton-oil, both by the mouth and injections, turpentine injections and fomentations to the abdomen, hot baths, and hot bottles to his feet, and beef-tea injections, were the remedies administered. *Post-mortem examination thirty hours after death.—External appearances.* Body stout and well formed; skin shrivelled, more particularly that of the hands and feet; features contracted and indicative of a person having died under great suffering; muscles rigid. *Cranium.* About one ounce of fluid at the base of the brain; veins of the pia mater congested, as also those of the velum interpositum and choroid plexuses; section of the brain presented many bloody points; weight of brain, 3 lbs. *Thorax.* The structure of both lungs was healthy; the posterior part of the right was attached to the chest by adhesions of long standing; the heart was of its natural size, and its structure healthy. *Abdomen.* On tracing the small intestines, five intussusceptions were found, the first situated a foot and a half from the duodenum, and the other four were generally from eight to ten inches apart. The portion intussuscepted was in each about two inches; there was no vascularity or congestions in the intussusceptions, or any of the abdominal viscera. Both portions of the stomach, viz., the part in the chest and the part in the abdomen, contained a quantity of dark fluid, mixed with portions of food and medicine. The duodenum and upper part of the jejunum, as far as the first intussusception, was distended with flatus; the small intestines below the invagination although not distended, but in their normal condition, were coated with mucus tinged with bile. The caput cæcum and ascending colon, to where it entered the chest, were distended, and contained a quantity of fluid and hardened fæces. The transverse arch of the colon was distended with flatus and some feculent matter; the descending colon and rectum were empty; liver healthy, weight,

4 lbs. 4 oz.; kidneys healthy, weight of right, 6 oz., left, 6 oz. 2 dwts.

Remarks.—Fletcher was in perfect health until immediately after he had taken a full meal, which, no doubt, he had frequently done since the time he had received the wound. It may, therefore, be asked what was the immediate cause of vomiting, and the sudden attack of illness; probably, the portion of the stomach still in the abdomen having become over-distended, spasmodic contraction of the diaphragm may have been induced, and prevented the food from entering the larger portion of the stomach, situated in the thorax; but it might have been supposed that after the contents of the lower portion had been ejected, irritability of this organ would have ceased, which did not take place, but continued to the last without the slightest alleviation.

The reason for supposing it was spasmodic contraction of the diaphragm is, that on examination the opening in this muscle was found large enough to admit two fingers with ease along the side of the gut.

Although it was, however, known that he had been wounded in the side, yet it was never suspected that the wound was in any way connected with the disease for which he was under treatment; his general appearance was most peculiar, the contracted state of the abdomen, the total absence of all pain in his belly after the first day, and of all inflammatory symptoms, and the occurrence of pain in his left shoulder. It is known that in diseases of the liver pain in the right shoulder is a common symptom. The pain in Fletcher may have had the same origin, whatever that may be, as no satisfactory explanation has as yet been given of it, except that it may depend upon some irritation of the ramifications of the phrenic nerve communicated along its course to its origin from the cervical and bronchial plexus, and then reflected by twigs distributed to the shoulder. A number of the symptoms which presented themselves in this case were those usually attended on strangulated inguinal hernia, viz., incessant vomiting and obstinate constipation, pulse small and wiry; but there was no stercoraceous vomiting, dissection showing that it could not occur.

The intussusceptions were the first morbid appearances seen

on opening the body, and the remark was immediately made that they did not present the appearance of invaginations which are the cause of death, but rather what are seen to take place during the latter stages of life when a patient has no symptoms of derangement of the intestinal canal. It is, therefore, probable that the intus susception took place after the commencement of the fatal disease, and was not the cause of it, but to be attributed to the violent peristaltic motions excited by the action of the croton-oil which was administered.

At the first view of the case it appeared to throw some light on the physiology of vomiting, as to how far the muscles of the abdomen and diaphragm co-operate with the stomach in this mechanical act. But the whole of the stomach not being displaced into the thorax, whatever influence they possess may have been, therefore, exercised on the part in the abdomen.

It is also to be supposed that the contents of the stomach, and transverse arch of the colon, situated in the thorax, remained the same from the time they became strangulated.

Mr. Guthrie's remarks as to wounds of the diaphragm never uniting may be the fact generally, but in a case where a wound of the diaphragm is small, and the patient is kept quiet and on proper diet, there appears to be no reason for supposing that the wound would not close; the base of the lung might adhere to the diaphragm, close up the opening, and so form a boundary between the thorax and abdomen, and thus prevent a hernial protrusion. Besides, it is only in those cases where a hernia has taken place that a surgeon, on an autopsy taking place, makes such a careful examination of those parts. I am, therefore, disposed to think that in some cases of wounds in the lower part of the thorax the diaphragm has been injured, and the patient has recovered from its effects so as never after to draw any attention to it; and that union of the divided fibres of the diaphragm or pleuritic adhesion have taken place in some cases, and prevented a hernia from forming, as is possibly the case in that of Greenfield and Eally, and others.

It is very remarkable that this extraordinary malposition of the stomach and colon should have produced so little inconvenience to the patient, and that in every respect Fletcher was in perfect health until strangulation took place.

The case of Sergeant Denis Barry, who was wounded in nearly the same situation, where there was also a hernia of the stomach and colon into the thorax, and continued to do his duty as a soldier for nearly twenty-two years, shows how little inconvenience he also experienced. Had the exact state of things been accurately diagnosed during life, what steps could have been taken for his relief? Would a surgeon be warranted in cutting into the abdomen and reducing the hernia? In this case it would have been impossible, on account of adhesions of the displaced viscera to the surrounding parts. The diagnosis of such a displacement would be extremely difficult, if not impossible. There was, in January, 1847, under my care in this hospital, a patient wounded in nearly the same situation, viz.:—Private Thomas Eally, æt. 25, was wounded on the 29th December, 1843, at Marajpore, by a grape shot, which entered about three inches below and to the outer side of the left nipple, between the eighth and ninth ribs; it was cut out shortly after the accident, behind and at the angle of the eleventh rib. He suffered severely from pleuritis of the left side in 1844. His general health is now (January, 1847) good, and he has no complaint except shortness of breathing, or rather uneasiness in his chest, when wearing his knapsack and cross-belts.

It is probable that the diaphragm was wounded in this case also; if so, the wound may possibly have closed, or pleuritic adhesions have formed and prevented a hernial protrusion. If, however, Eally was seized in the same manner as Fletcher, after all other means had failed, should operative measures be resorted to? I am disposed to think that few surgeons would be inclined to undertake such an operation from the great uncertainty as to the state of the parts that might exist.

CHAPTER VII.

GUNSHOT WOUNDS OF THE HEART AND GREAT VESSELS.

Several cases are on record of patients having lived for days and even weeks after wounds of the heart, but all these cases are exceptional, and are only objects of curiosity, and show what amount of injury these important organs can bear without proving immediately fatal.

The Museum can only furnish three cases of these formidable wounds.

The following preparation, No. 173, exhibits a lance wound which penetrated the right ventricle through the diaphragm. Death five days after the wound. J. Dierking, a stout muscular man, of the 3rd German Hussars, was wounded at the Battle of Waterloo by a lance, which penetrated the chest between the fifth and sixth ribs, and was then withdrawn. He fell from his horse, lost a good deal of blood by the mouth, and some by the wound, and was carried to Brussels without any particular attention being drawn to the injury. His strength not being restored, whilst he suffered from palpitation of the heart, and other uneasy sensations in the chest, he was sent to England to be invalided, and in November, 1815, to the York Hospital, Chelsea, in consequence of an attack of pneumonia, of which he died in two days, without attention being particularly drawn to the cicatrix of the wound. On examining the body it was found that the lance, having injured the edge of the cartilage of the rib, passed through the inferior lobe of the left lung, the track being marked by a depressed narrow cicatrix. It then perforated the pericardium under the heart, and sliced a piece out of the outer edge of the right ventricle, which being attached below, turned over and hung down from the heart to the extent of two inches when

in the fresh state, the part of the ventricle from which it had been sliced being puckered and covered by a serous membrane like the heart itself. The lance then penetrated the central tendon of the diaphragm, making an oval opening, easily admitting the finger, the edges being smooth and well defined. It then entered the liver, on the surface of which there was a small irregular mark or cicatrix. The heart in front was attached to the pericardium by some strong bands, the result of adhesive inflammation, but the general appearance of the serous membrane showed that this had not been either great or extensive. The donor, Mr. Guthrie, remarks: "If this man had lived long enough, he might have furnished an instance of hernia of the stomach or of intestine into the pericardium." In the truth of this remark few surgeons would now concur.

No. 174.—A punctured wound of the right ventricle, close to the apex. Instant death.

No. 403.—Abdominal aorta showing a horizontal wound through its coats, caused by the point of a bayonet. Death three hours after.

A European was admitted after the battle of Sadoolapore, in 1849, with rupture of the septum cardis, but without any wound of the chest or fracture of ribs. He had been struck with a cannon shot immediately over the breast, and under the nipple on the left side. The chest presented the appearance of only a very slight bruise, the skin not being rubbed off; however, he appeared dying; pulse small, frequent, and feeble; surface cold and moist; countenance anxious. Stimulants, opium, &c., were of no use, and after four days he died. The post-mortem examination showed ecchymosis under the skin, ecchymosis of the anterior surface of the heart, and on laying it open, the septum cardis was found ruptured, so that the finger could be passed from one ventricle to the other, through a jagged and ruptured opening.

CHAPTER VIII.

GUNSHOT WOUNDS OF THE ABDOMEN.

Simple Flesh Contusions and Wounds.

When the abdominal walls are divided to any extent by a musket ball or by a sharp-cutting instrument, ventral hernia is very liable to take place. Occasionally a ball striking obliquely against the parietes, runs for a considerable distance under the skin, or partly between the peritoneum and muscles, in which case the course of the ball will be usually marked by a line on the skin of a reddish-blue colour, and the constitutional alarm will not be to any great extent and will soon subside. Abscesses are apt to form in the abdominal walls after severe injuries from stabs, or from gunshot, &c., and require to be opened early. Severe contusions from falls or blows may produce rupture of the intestines or of the solid abdominal viscera, and death take place within a short time.

When there is rupture of any of the hollow viscera, there is extravasation of gas and of the contents of the intestines to a greater or less extent, causing rapid swelling and tension of the belly, which is a tolerably certain symptom of rupture of the gut.

The solid viscera are sometimes ruptured by falls or contusions from cannon shot, without causing much injury to the skin of the abdomen, and the patient generally dies from hæmorrhage.

Wounds of the walls of the abdomen without penetration of the peritoneum and without internal injury, are to be treated on ordinary principles. In incised wounds the stitches should be inserted through the skin only, and the parietes should be relaxed by careful attention to position. When the symp-

toms lead to the supposition of laceration of one of the viscera, the only thing to be done during the state of collapse is to keep the patient quiet and to use means to lessen the effects of the shock upon the system; and should the patient survive this period, peritoneal inflammation must be guarded against.

Four cases of simple flesh wounds arrived from India, and were discharged to duty. In one case the ball was reported by the surgeon of the regiment to be lodged somewhere above Poupart's ligament; profuse hæmorrhage followed, which stopped of itself. In another case the ball entered below the ensiform cartilages on the right side and passed out at the extremity of the last floating rib on the right side. The third was a slight wound from grape shot.

Contused and Non-penetrating Wounds.

Two cases were admitted from India, and were sent to duty.

64th Regiment.—Private James Falloon,* wounded at Cawnpore, November 28th, 1857, by a musket ball, which entered two inches below the ensiform cartilage on the right side, and at the margin of the cartilage of the false ribs, and passed downwards and backwards, and was cut out opposite the extremity of the last floating rib. He vomited florid blood, according to his own statement, at the time; there was no external bleeding. The ball passed behind the ribs, and there is little doubt that the peritoneum was slightly wounded, and probably the diaphragm. August 18th, 1858.—Wound healed. Duty.

35th Regiment.—Private John Lowe, æt. 39, wounded January 25th, 1857. The ball entered the abdomen on a line with the margins of the ribs, and near their angles; it was extracted shortly after through an incision made in the gastric region, it having lodged beneath the skin in that locality; no discoloration of the integuments between the entrance of the ball and where it was cut out was at any time perceptible to mark its course; he vomited blood at the time; had not any external

* Noticed by Assistant-Surgeon Chaumont, Rifle Brigade, in the 'Edinburgh Monthly Journal' for December, 1858.

bleeding; his wound healed in the usual period, and he was discharged from hospital six months after its receipt. He has since suffered much from pain and tenderness in the region of the epigastrium, and he has been unable to wear his accoutrements, the pressure causes so much suffering; under the circumstances, he is unfitted for the active duties of a soldier. April 28th.—Invalided.

Penetrating or Perforating, with Lesion of the Intestines or Solid Organs.

Penetrating wounds may be divided into those that penetrate the peritoneum without wounding or causing protrusion of any of the contained organs; and those where there is protrusion or wound of some of the viscera.

The first description of wound cannot in many cases be distinguished from simple flesh wounds, although the escape of a small quantity of reddish serum may reveal the nature of the accident; but the probe must not be used to ascertain the state of parts, and should peritonitis supervene, it must be treated according to the usual principles of surgery. In penetrating wounds caused by cutting instruments or by musket balls, with protrusion of a portion of omentum or intestine, the great danger is extravasation of the intestinal contents, or the effusion of blood, causing peritonitis. When a portion of intestine or omentum protrudes through the wound, and without any injury, it soon loses its polished and bright colour, and becomes dull and livid from congestion, and if the strangulation continues, inflammation and gangrene takes place. A portion of unwounded but protruding intestine should be returned as soon as possible, before sloughing takes place. When the protruded intestine is wounded, flatus or some of its fluid contents will be observed to escape. When there is only a mere puncture, or an incision two or three lines in length, an eversion of the mucous membrane takes place, so as to prevent the escape of its contents. When the opening is more than four lines in length, the everted mucous membrane cannot prevent the flow of the contents, but still it assists, in some

measure, the escape of the intestinal contents. When the intestine is wounded, but does not protrude from the abdomen, extravasation of feculent matter is liable to take place; still it does not occur so frequently as might be expected, in consequence of the steady and equal pressure of the abdominal muscles and of the diaphragm upon the different viscera, that it requires some degree of force for the feculent matter to overcome this uniform support; besides, when the wound in the gut is less than a certain size, there is a natural tendency to close the aperture by the eversion of the mucous membrane. Therefore, unless the wound is very extensive, or the gut is very full at the time of the injury, fæces are seldom extravasated.

Blood is more easily extravasated than the contents of the intestines, on account of the force of the circulation overcoming the pressure of the abdominal walls. These extravasations, viz., of fæces or blood, generally become circumscribed in small collections between the folds of the intestines, close to their origin, and therefore the chances of general peritonitis is greatly diminished. These localized swellings can occasionally be recognised by dulness on percussion in the situation of the wound, and sometimes it escapes by the external aperture.

When the intestine is wounded, but not protruding, the object is to prevent feculent extravasation, and to localise the peritonitis that may ensue; the patient should be laid on the injured side, with the wound dependent, so as to allow of the escape of fæces; two grains of solid opium, or forty minims of the Liq. Opii Sodat., should be given, and the system kept well under its influence. The effect of the opium seems to moderate the peritoneal inflammation and the peristaltic movements of the intestines, and thus prevents the change of position, and diminishes the chance of the escape of its contents. Wounds of the intestines are closed by lymph, which is thrown out, not only from the contiguous peritoneal surfaces of the part actually injured, but from that of neighbouring convolutions, so that the wounded intestine, in some instances, becomes attached to the surrounding structures.

When extravasation of feculent matter has taken place into the peritoneal cavity, the stitches and bandages should be removed from the external wound, so as to allow of the escape of

the effused matter, and the patient placed on the injured side, with the wound in a dependent position.

When a portion of intestine or omentum protrudes, it might be returned before gangrene has set in, and this is greatly facilitated by relaxing the abdominal muscles; should it be found impossible to effect reduction, in consequence of constriction of the neck of the wound, it may be enlarged by a probe-pointed bistoury, in a perpendicular direction. The gut must be simply replaced, and allowed to remain close to the wound, to which it will become adherent, and in the event of sloughing taking place, it will facilitate the escape of its contents. When the intestine has become gangrenous, an incision should be made into it, so as to effect the formation of an artificial anus. When the omentum is gangrenous, it must be excised.

When the protruding intestine is also wounded, it has become a question as to the propriety of stitching up the wound in the gut, or returning the wounded intestine, taking care, however, that the two apertures correspond as far as possible. It is now the practice to stitch up the wounded and protruding intestine by the "glover's stitch," by means of a fine round needle, armed with sewing silk, and the peritoneal surfaces on either side of the wound are alone brought into contact, as adhesion takes place solely between them. The thread should only be inserted through the peritoneal and cellular coats, and not through the muscular, lest retraction of the included muscular fibres, by dragging upon the stitches, might reopen the wound. The ends of the thread should be cut close to the knot, and the suture will eventually become covered with lymph, and find its way into the inside of the gut, by ulcerating through the mucous coat. It has been proposed to leave the end of the thread hanging out of the abdominal aperture, but this is more likely to induce peritoneal inflammation.

The wound in the intestine having been sewn up, should be reduced and kept close to the external wound, so that, should the stitches give way and extravasation take place, it may be allowed to escape readily. The position of the patient must be carefully attended to, so as to relax the abdominal muscles, and the administration of opium, to keep the bowels quiet. Food should not be allowed for the first three days, but

only tea and barley-water, and afterwards beef-tea and light food that leaves little residue, may be administered. No purgatives should be given, and the urine should be drawn off.

In all wounds of the abdomen the great danger to be apprehended is from diffused peritonitis, caused by the extravasation of fæces or blood, in which case there is great tenderness over the abdomen, especially around the wound, accompanied with vomiting and tympanitis; small, wiry pulse, fever, &c. When the patient is stout and plethoric, leeches should be applied to the abdomen, and calomel and opium administered, and strict abstinence enjoined.

Wounds of the liver, although of a very formidable character, are not necessarily fatal, death being caused by inflammation of the substances of the liver, or by peritonitis. Portions of protruded liver have been excised, and the patient recovered. (*Vide* case by Dr. Macpherson, Assistant-Surgeon, 9th Lancers, 'London Medical Gazette' for 1846.)

Wounds of the stomach are generally fatal; when the stomach is empty there is less chance of peritonitis being excited by the effusion of its contents into the abdominal cavity. The cut edge of a wound in the stomach is to be treated in the same manner as in the intestines. In gunshot wounds of the stomach, the edges will not unite for several days, so that the patient must be placed that the contents may escape externally. Should the patient survive the inflammatory stage he should be supported by clysters of beef-tea, &c.

Wounds in the stomach sometimes become fistulous, as in the well-known case related by Dr. Beaumont, of the American army, who, in 1822, received an extensive wound in the stomach, admitting of most interesting inquiries being made into the process of digestion.

Wounds and injuries of the spleen are usually fatal, either from hæmorrhage or inflammation.

The spleen is sometimes ruptured from falls, or from cannon shot.

Wounds of the kidney are also generally fatal, although there are cases on record of the patients having lived for some time after such injuries.

Two were admitted from India, and both were invalided.

It is well known that gunshot wounds of the solid viscera, as also those of the small intestines, are generally fatal; still, this is not invariably the case, as is seen by the very fine specimen No. 1271, page 111, Plate V. Wounds of the large intestines are also not so formidable or dangerous, especially when the wound is in the neighbourhood of the cæcum or sigmoid flexure, where the intestine is more fixed and bound down, and only partially covered by the peritoneum.

Two cases of abnormal anus by gunshot perforation appear to be a large proportion to the total wounded, 842. The 2296 cases of wounded from the Crimea furnish only one such case, Private James Beehan, 19th Regiment, who is now in Guy's Hospital, never having recovered from the wound, though it has occasionally closed and again reopened, as has taken place in every one of the three cases now detailed. A note from Mr. Birkett, dated 21st January, 1859, says: "He (Beehan) has since my last report suffered with severe attacks from albuminuria, and is anasarcous." For particulars of this case, *vide* p. 330 of the Report on Crimean Wounded. Since the above was written, this case has terminated fatally; and the post-mortem appearances have been kindly furnished by Mr. Birkett:—Private Beeham was admitted into Guy's Hospital, December, 1858, and died in February, 1859. The peritoneum and the abdominal viscera were healthy, except adhesions between the spleen and left kidney and colon. In the left loin a fistulous opening led directly into the descending colon; it passes immediately below the lower edge of the left kidney. A sinus extended downwards behind the left colon as far as the ilium. A small piece of lead was fixed in the capsule of the spleen, but gave rise to no disease. Parts of the two lowest left ribs were necrosed. The lumbar vertebræ were slightly curved to the right side. A hole with smooth edges was seen between the left transverse processes of the second and third lumbar vertebræ. It corresponded to the intervertebral foramen, but was larger than natural, and admitted the finger into the vertebral canal. From this the *bullet* had doubtless made its *exit into the colon.* It was difficult to find the point of entrance of the ball, as the original wound had healed, and the tissues around were much indurated. The cicatrix in the skin of the lumbar region was

seated a little to the right of the spinous processes of the fourth lumbar vertebra; and on dissecting down to the arches it was evident that the ball had entered between the arches of the third and fourth lumbar vertebræ, fracturing their arches and passing along the third lumbar, making its exit between the transverse process of the second and third. The arches of the third and fourth lumbar vertebræ, which had probably been broken, were now anchylosed. It will be remembered that the ball struck him whilst he was crawling along the ground, and it took an upward direction. It entered to the right side of the spinous process of the fourth lumbar vertebra, passed behind the body of the third lumbar and spinal cord, and emerging between the transverse process of the second and third lumbar on the left side, entered the left or descending colon and voided per anum. For some weeks after the injury fæcal matter passed by the primary wound, but at last this entirely healed. For a few weeks, although suffering pain, he was free from any fæcal fistula. An abscess then formed in the left groin, which broke and continued open to the end; through this fæces continually passed. Both kidneys were very large, white, and granular. The connective tissues of the body generally were infiltrated with serum.

In the case from which preparation No. 1270 (page 110, Plate IV, fig. 1) was taken, the wound is likewise on the left side, and the colon was wounded at a part where it is *entirely covered* by peritoneum. This makes the fifth case of wound of the large intestine detailed in this Report, and in that of the wounded from the Crimea.

It is worthy of remark that in all these five cases the artificial anus is on the left side, and almost precisely in the same situation, with the exception of the one, No. 1270. In Hogan there was a partial fracture of the ilium. In Beehan there was an injury of the vertebræ, and probably also of the kidney. In M'Cartney and Henderson there was no such complication. Private Henderson was under my care in 1844.

As already stated, all these five cases of wounds of the large intestines, and also the three of the diaphragm, are on the left side. This at first sight would lead to the supposition that the left side of the body was more exposed in action than the right,

and might probably be accounted for by soldiers placing the left side more forward when in the act of firing, supposing that the wounds were received when in this position. This appears, however, not to be the case, but is to be attributed to wounds of the right side of the abdomen being more fatal than those on the left, in consequence of the liver occupying so much space on that side; for on examining the wounds in the thorax received from India, out of nineteen I find that fifteen were wounded on the right, and only four on the left side.

The following three very interesting cases of gunshot wound of the sigmoid flexure of the colon are examples of this lesion.

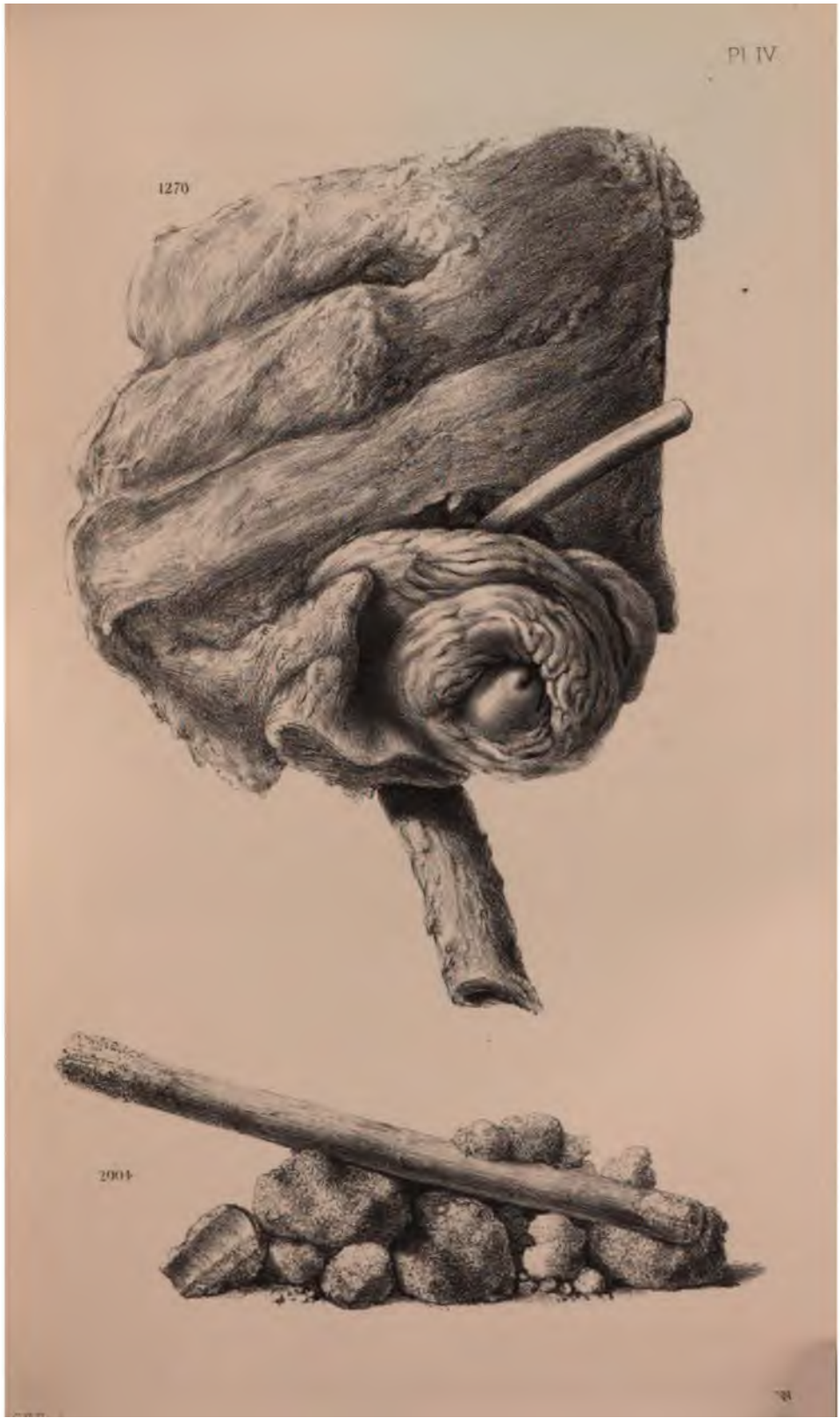
32nd Regiment.—Private Cornelius Hogan,* æt. 34, wounded June 20th, 1857, at Lucknow, in the left hip, an inch and a half below the crest of the left ilium, and nearly midway between the anterior and superior spinous process of the ilium and the spinous process of the back. The ball entered and must have passed into or wounded the sigmoid flexure of the colon, and is supposed still to remain in, as it has never, as far as the man knows, been passed by stool. For twenty-two days he passed his fæces entirely through the opening, but since then he has never passed any feculent matter through the wound, but only flatus; this also has ceased for the last fortnight, but there is still a considerable discharge of purulent matter, and he complains of pain in the back. He was transferred from Fort Pitt to Yarmouth Hospital, July 4th, 1858, and from thence was sent to the depôt of his regiment, which he joined on October 28th. He was tried by court-martial on December 9th, and was sentenced to forty-two days' imprisonment at Fort Clarence, with such labour as the surgeon in charge considered him capable of performing without risk. Previous to appearing before the surgeon he had undergone an hour's short drill, which caused the wound to reopen. He was consequently sent to the garrison hospital, and was transferred to Fort Pitt, January 29th, 1859, with fæces still passing through the wound. March 13th, 1859.—Wound healed, and he enjoys good health; but has been invalided as being unfit for further service.

* This case is noticed in the 'Edinburgh Monthly Journal' for December, 1858, by Assistant-Surgeon Chaumont.

10th Regiment.—Private Michael M'Cartney, æt. 27, wounded by a musket ball, May 11th, 1858, at Chitawarah, which passed through the left side of the body, from behind forwards, passing through the diameter of the colon. For a period of three months he passed fæces through the opening. February 25th, 1859.—Wound still continues to discharge; complains of great pain in the abdomen; has piles, and is troubled with diarrhœa; he is rather anemic in appearance. March 4th.—Diarrhœa still continues; a truss has been applied over the fistulous opening. 10th.—The truss discontinued, as it causes much flatulence. 15th.—No improvement; complains of cold and shivering.

13th Regiment.—Private John Henderson, æt. 36, wounded at Cabul, in October, 1840, by a musket ball, which entered the left side at the extremity of the last rib, and made its exit about two inches from the spine, passing obliquely downwards and backwards, penetrating the colon, followed by very profuse discharge of fæces; the wound was of a very dangerous nature. He was taken prisoner, and suffered great privations. He was admitted into Fort Pitt, July, 1844, with both apertures of entrance and exit of ball discharging fæces. Various methods of treatment were tried to effect a cure, but without success; the wounds would close for a short time, and then break out again, so that he was eventually dicharged the service, August 26th, 1844.

The following preparation is from a sailor who was wounded in the act of rowing towards the enemy. It is to be regretted that there is no detailed history of this interesting case; but, from the state of the parts now exhibited, there can be no doubt that the patient lived for some time, perhaps years, in a most wretched condition. No. 1270.—Gunshot wound of the large intestine, terminating in artificial anus. (*Vide* Plate IV., fig. 1.) The ball entered on the left side, wounded the colon as it was curving downwards to become the descending colon, and passed out, fracturing the eleventh rib at its anterior third. The aperture in the abdominal walls is about three inches in diameter, and a knuckle of intestine protrudes. The opening in the gut is about one and a half inches in diameter, and the mucous service is everted and has become very firmly united to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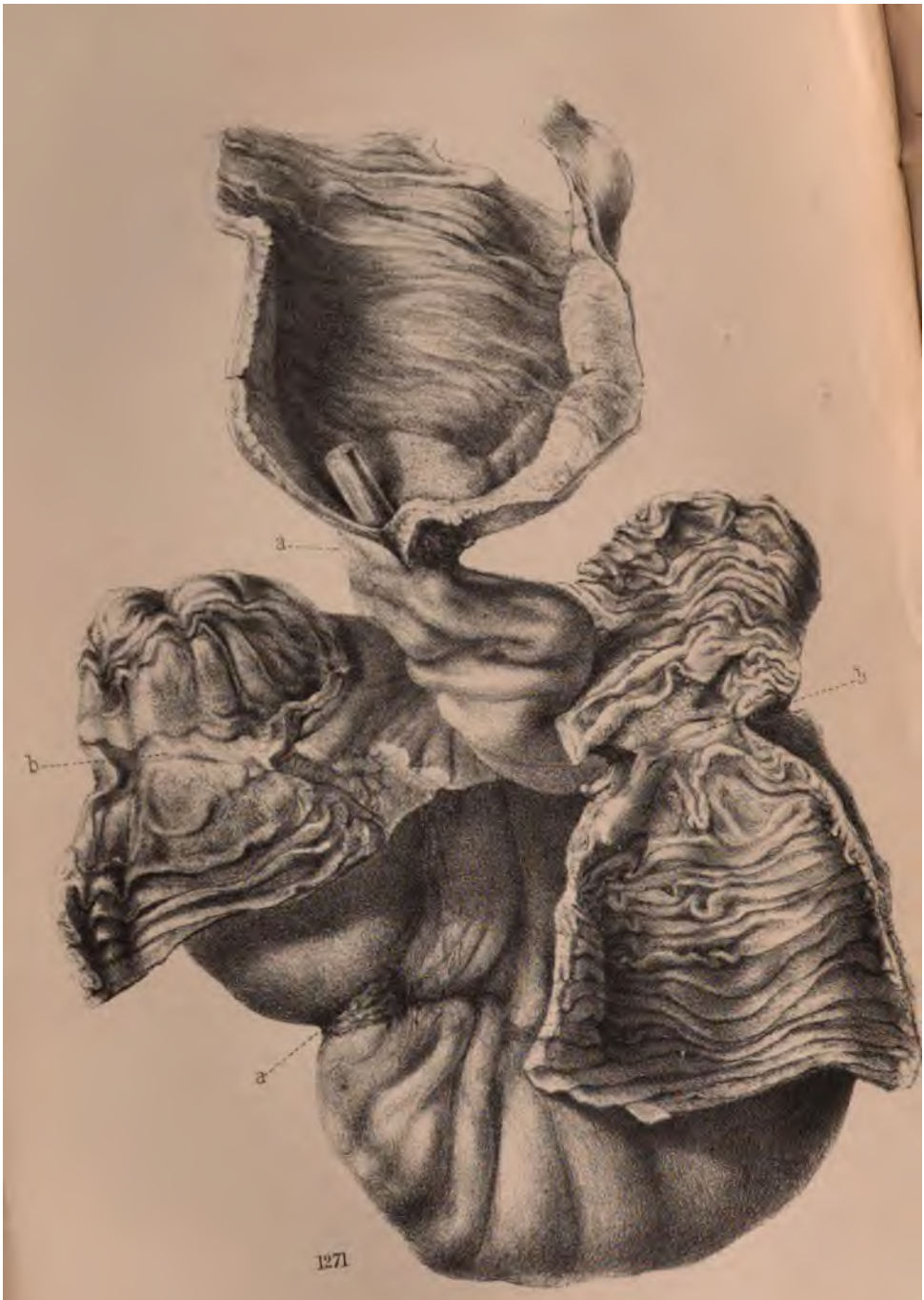


1271

a Contractions.
b Contractions laid open.

G.H.Ro.

the integuments by adhesions of old standing. So much is this the case, that the mucous membrane and skin have become quite continuous, the intestine has also contracted firm adhesions to the adjacent peritoneum on the inner side. A quill is inserted into the upper part of the gut, which is of the usual caliber, and the mucous membrane is healthy. The bowle below the wound is very much contracted from want of use, but pervious. The fæces were voided through the preternatural opening.

The following preparation of a perforating gunshot wound through several folds of the small intestine, followed by recovery, is, as far as I am aware, quite unique. No. 1271. (See Plate V.)—Two pieces of the small intestine; jejunum showing the results of injury by gunshot wound. The larger piece of intestine exhibits three constrictions of that gut, two of which have been laid open to show the interior, and the third one remains entire. In the inside these contractions present much the appearance of a cicatrix, being totally devoid of the normal villous character of mucous membrane of the intestine; above and below it is bounded by a sharp and well-defined line of the natural lining of the intestine. Externally these constricted points are covered by a layer of old granular lymph; they were of a darker hue and more vascular than other portions of the small intestine, which, however, presented throughout the arborescent vascularity and soddened state constantly observed in rapidly fatal cases of blue spasmodic cholera. The smaller piece of intestine exhibits a fourth constriction of the gut, capable of admitting only a good-sized quill.—*Donor*, J. R. Taylor, Surgeon 80th Regiment. This preparation is from Private Paul Massey, 80th Regiment, who was shot in the abdomen at the battle of Ferozeshah, December 22nd, 1845. The symptoms consequent immediately upon the wound appear to have been so inconsiderable that it is recorded by Dr. MacDonald (then surgeon of the regiment), that it was his opinion that the ball had coursed round the abdomen, and not penetrated or passed through that region. The patient, however, shortly before his death, stated he had passed blood by stool after the receipt of the injury. Recovery followed slowly, but appeared to be perfect. The soldier, how-

ever, became subject to attacks of bowel complaint, gradually becoming more frequent, and for the last twelve months of his life he was nearly constantly under treatment for symptoms of dysentery of the land scorbutic type. Whilst in hospital on account of this disease, he was seized, on the 13th May, 1851, with blue spasmodic cholera, terminating fatally the same day. Death five and a half years after being wounded. Cholera was then prevalent in the neighbourhood, and became epidemic in the regiment in the following month. *Post-mortem appearance, an hour and a half after death.*—*Externally.* Livid; but less so than during life; not much emaciated; cicatrix of a wound in left linea semilunaries, about four inches above the crista ilii, and on the same plane posteriorly, another cicatrix, an inch to the left of the spine.—*Head.* General livid appearance of meninges and cerebral substance, some milky opacity on the upper surfaces of the hemispheres, slight serous effusion under arachnoid. — *Thorax.* Adhesions on the right side; lungs partially collapsed; structure healthy; heart normal; fluid blood in left ventricle.—*Abdomen.* Omentum firmly adherent to the internal surface of anterior cicatrix, and gathered into a knot at that point. The intestines neither there nor elsewhere morbidly adherent, but the fold of intestines immediately opposed to the cicatrix presented a line of contraction, as if a ligature had been tied round the gut. The fold of intestine immediately above presented the same appearance, and on the first fold, four inches from the first noticed contraction, and situated in a line below the umbilicus, was another similar appearance. The mucous surface of the small intestine generally was pale-pinkish in colour; no ulceration of large intestine; upper part of colon attenuated and contracted in situ; rectum thickened; stomach pale; liver small, congested; gall-bladder half filled with dark viscid bile; spleen small; kidneys healthy. (See Plate V.)

It is curious to remark, on post-mortem examination of a case of direct gunshot perforation of the abdomen, that the intestine is wounded in many places considerably removed from the direct course of the ball. *Is this removal of wounded portions of intestine from the line of the ball due solely to the natural peristaltic action, or to something more than this, as the*

result of the injury? Probably the latter influence is considerable; as it has been remarked, and I believe truly, *that under perforation of the intestines by ulceration there is not only contraction in caliber, but marked shortening of the intestinal canal.* This action beyond the peristaltic may be expected, and really appears to follow *equally perforations by injury and disease,* thus explaining the withdrawal of the wounded points of intestine from the line of the ball, as indicated by the orifices of entrance and exit.

In a case that came under the observation of Deputy Inspector-General T. Alexander, C.B., the small intestines were found to have been wounded sixteen times;* and in preparation No. 1272 the small intestines are perforated four times and the mesentery twice.

No. 1272.—Gunshot wound of the small intestines and mesentery, the former wounded in three places, and the latter in one. Death twenty-four hours after the accident.

No. 1125.—A gunshot wound of the large curvature of the stomach. The man lived eight hours after the accident.

* Mr. Guthrie's 'Commentaries,' p. 576.

CHAPTER IX.

GUNSHOT WOUNDS OF THE BACK AND SPINE.

Gunshot wounds with fracture of the vertebra without lesion of the spinal cord are in general very tedious and slow to cure; sinuses form along the spine and are very troublesome; the spinous or transverse processes become carious; balls and pieces of cloth are sometimes lodged, and require free incision for their removal.

Ten have been admitted: six have been discharged to duty, and four invalided; all were the result of musket balls; one was a case of fracture of the ilium and spinous process of the lumbar vertebræ, with the wounds still unhealed. One with fracture of the spinous process of the dorsal vertebræ; wounds still open.

Two cases of wounds of the sacrum; in one of them the wound was still open, and a probe could be passed right across from the one aperture to the other. The last was a wound of the spinous process of the lumbar vertebræ, also still unhealed.

The two following cases are examples of this description of wound.

93rd Regiment.—Sergeant James Munro; wounded at Lucknow by a musket ball through the loins; the ball entered a little behind and below the crest of the left ilium, and passed a little upwards and backwards, nearly across the back, and made its exit immediately above the crest of the right ilium; numerous pieces of bone came away from both apertures. Shortly after the injury the urine was tinged with blood, and it is doubtful whether the two last vertebræ are injured. 12th July.—The aperture of exit of ball has closed; that of entrance is still open and discharging, and the probe can be introduced for a considerable distance, but bare bone is not detected; he is

unable to sit upright, and he has lost considerable power over the limbs; has incontinence of urine. Invalided 29th September, 1858.

24th.—Private Patrick Farrell, æt. 30, wounded 7th July, 1857, by a musket ball, which entered on the right side of the third lumbar vertebra, two inches from the spinous processes, passed across the back, and made its exit a little below the centre of the crest of the left ilium; several pieces of bone came away from the aperture of exit. August 2nd.—Aperture of entrance is healed; that of exit is still discharging, leading down to diseased bone. There is some thickening over the spinous processes of the lumbar vertebræ. Undisposed of.

Pelvis.—Balls sometimes pass across from one side of the pelvis to the other, without entering the cavity. When a ball is allowed to remain in any of the bones of the pelvis, it is the source of great annoyance, and gives rise to disease of the bones, profuse discharge, and probable death. When a ball lodges or is impacted in the flat bones, incisions ought at once to be made through the muscular substance for its removal.

Lesion of the Spinal Cord.

When the spinal cord is injured, either by gunshot, dislocation, or fracture, there is, in general, partial or general paralysis in some of the parts below the seat of the injury. The ball should, if possible, be removed. The patient should be placed on an air or water-bed, and kept scrupulously clean and quiet, the urine drawn off by the catheter, and every means taken to prevent sloughing of the back and nates.

None were admitted from India; but the following cases from preparations in the Museum illustrate this injury.

No. 2912.—Dorsal portion of the spine, showing a bullet lodged in the canal. The ball appears to have entered exactly through the centre of the arch, which, with the spinous process, is partly broken away. From a sergeant of the 5th Dragoons, who was shot by a private of the regiment.

No. 2913.—Is from Private R. Greive, 3rd Light Dragoons, who was wounded at Rhamnuggur, November 21st, 1849, by a

musket ball, which entered below the right mamma, penetrated the lower lobe of the right lung and diaphragm, grazed the upper surface of the liver, and passed between the head of the eleventh rib and the vertebræ. It lodged in the spinal canal, and caused paraplegia. Death four days after the injury.

No. 2914.—Fifth dorsal vertebra, exhibiting fracture of part of the right side of its arch by a pistol ball, which is lodged in the canal. The ball entered the right deltoid muscle, and proceeded downwards on the outside and upper part of chest near to the spine, and finally lodged in the canal. The course of the ball was not known till the death of the patient, which took place thirty days after the injury. The body and limbs below the navel were deprived of sensation and motion; the urine required removal by the catheter, or dribbled away; and the fæces were passed involuntarily; followed by sloughing of the integuments of the sacrum and trochanters. From an officer who was wounded in a duel.

No. 2915.—Is a gunshot fracture of the atlas and axis. The ball dropped into the mouth, and the man died in thirty days after the wound.

CHAPTER X.

GUNSHOT CONTUSIONS AND WOUNDS OF THE PERINEUM, AND GENITAL AND URINARY ORGANS, NOT BEING, AT THE SAME TIME, WOUNDS OF THE PERITONEUM.

Wounds of the testicle and spermatic cord are not unfrequent, and usually heal rapidly; but the portion which remains is often of little use, although the patient does not like to lose it.

When the urethra has been wounded, a moderate-sized catheter should be kept in, to assist, during the healing of the parts, in preventing contraction of the canal.

Spent round shot striking the pubis sometimes causes paralysis of the bladder, without producing any external wound.

Wounds of the bladder by musket ball are very dangerous, but not necessarily fatal. When the bladder is wounded where it is uncovered by peritoneum, the patient generally recovers; but when the wound in the bladder is at any part that is covered by peritoneum, the case is almost certain to terminate fatally, from extravasation of urine and consequent general peritonitis. In all these cases a catheter should be at once introduced into the bladder, and retained there until the urine ceases to flow from the wound; the urine should be allowed to drop out of the catheter nearly as fast as it passes into the bladder. The catheter should not be introduced too far into the bladder, lest it excites inflammation of the bladder, or rise above the urine, which might collect below it, and at last escape through the wound.

Inflammatory symptoms are to be combated by general and local bleeding, enemata, and gentle aperients, and opium given, so as to produce some effect on the system.

When a ball lodges in the bladder or prostate, it ought to be removed by operation through the perineum.

Four very interesting cases have been admitted from India. In two very similar cases the ball passed through the left testicle, injuring the urethra, so that the patients passed urine for some time through the wounds in the urethra (as was stated in the case-book of Assistant-Surgeon Smith, 9th Lancers, who had medical charge of the men on the passage home); the fistulous opening in the canal closed entirely, and the natural passage remained undiminished in size, allowing of a full-sized catheter to pass with ease into the bladder; one lost both testicles; two of them were sent to duty, and two invalided. The fourth case was from a spent round shot, which struck the man over the pubis without injuring the integuments, producing incontinence of urine.

1st Battalion, 60th.—Private Peter Forbes, æt. 32. Wounded at Delhi, June 18th, 1857, by a musket ball, which struck the left testicle, passed through the pubis and bladder, and made its exit posteriorly in the centre of the right hip. The left testicle was so much injured that it was removed the same day. He passed his urine for one month entirely through the wound. April 10th, 1858.—A large bougie was passed with perfect ease. 20th.—The sinus does not now appear to communicate with the urethra. May 1st.—Removed to-day a small piece of bone from the depth of the length of the forceps, in the pelvis. There is no communication between the sinus and the urinary passages. 10th.—Another small piece of bone taken away from the same depth as the former piece. 13th.—The wound remains in the same state; a piece of bone can be felt by the probe, very deep, and apparently loose, but cannot be reached by the forceps. June 4th.—Succeeded in reaching and removing two pieces of bone, evidently from the internal surface of the ischium. 11th.—There has been less discharge, and he is quite free from pain, and can walk about. July 21st.—Wound quite healed. Modified duty.

75th Regiment.—Private S. Young, wounded at Delhi, September 14th, 1857, by a musket ball, which struck the left side of the penis, injuring the urethra and left testicle; then entered the inner side of the left thigh, and made its exit through the centre of the hip posteriorly. The left testicle came away shortly after, and he passed his urine through the wound in the side of

the penis. 20th.—All the wounds are now healed; No. 8 catheter can be passed with ease. July 21st, 1858.—Duty.

88th Regiment.—Private William Smith, wounded at Cawnpore, November 26th, 1857, by a spent round shot, which caused a bruise over the symphysis of the pubis and outer side of the left thigh; has never since been able to retain his urine. August 16th, 1858.—His urine passes constantly from him without the least control over it. He has been supplied with a patent urinal. He complains of weakness in his loins, but is otherwise in good health.

No. 2956.—Cast of a section of a urinary calculus which had a musket ball for a nucleus.—*Donor*, Sir G. Ballingall, Edinburgh.

In the following case, which occurred during the Punjaub Campaign in 1848 and 1849, a ball entered the pelvis and disappeared; he was sent to the Landour Depôt, where symptoms of stone in the bladder came on, and on the usual operation for lithotomy being performed, a grape shot was extracted from the bladder, coated with urinary deposit. It was presumed that the bullet in the first instance was not lodged in the bladder, but had afterwards found its way into that cavity by process of inflammation and ulceration, and perforation of the coats of the viscus, as all foreign substances lodged in the centre of the body have a constant tendency to find their way by ulceration to the nearest cavity by which it is possible for them to be externally expelled. 24th Regiment.—Private W. West, æt. 22, service four years, healthy and of sound constitution, was admitted into the Field Hospital after the action at Chillianwallah, 13th January, 1849, having received a wound about the centre of the left nates, somewhat above and external to the left sciatic notch, from a bullet which lodged internally and was extracted by E. Macpherson, Assistant-Surgeon, 9th Lancers, by the lateral operation for lithotomy, on the 30th August, seven months after the wound. When brought off the field he pointed to the left side of the raphi of the perineum, immediately below the left spermatic cord, as the part in which he supposed himself to have been wounded, from the pain he felt in that situation, but no sign of injury could be discovered then. Six weeks after its receipt the wound had healed without any untoward symptom

or sign of injury to the bones of the pelvis, but frequent pain in the perineum continued, and symptoms of inflammation of the mucous lining of the urethra and bladder (viz., pain in the urethra during and in the fundament after micturition, gleety discharge from the urethra, with deposit in the urine and general febrile irritation) which first appeared a fortnight after he was wounded, became gradually more urgent under the treatment adopted, on the supposition that they were the consequences of gonorrhœa, from which he said he had suffered lately in much the same way. In June three attempts were made to sound the bladder; but from the excessive pain caused by the instrument in the urethra it was withdrawn without any result obtained, and from the aggravation of the symptoms which followed its introduction the use of it could not be often repeated. On the 10th July, during a remission of the symptoms, which had materially impaired his general health, the bladder was sounded, and a substance of no great size, supposed from the history of the case to be the bullet, was discovered loose within it. On the 30th August the usual lateral operation was performed, and an iron grape shot, with a rough, jagged surface, encrusted with a slight sandy deposit, weighing one ounce and thirty-eight grains, was extracted from the bladder. 2nd November, he was almost quite well.

The following case illustrates the tricks that soldiers play upon each other. Private James Hussey, æt. 25, 18th Regiment, had served abroad seven years, of which upwards of six were spent in China. At Hong Kong, on the 24th October, 1845, he was taken to the guard room in a state of intoxication, and on becoming sensible he found a piece of cane, about a foot long, in the urethra, retained by a string tied round the penis, and the removal of which was attended with slight hæmorrhage. About a month afterwards he complained of pain over the pubis, and difficult micturition, the urine when passed being mixed with blood and mucus. On introducing a catheter into the bladder, a grating sensation was experienced. He was admitted into Fort Pitt Hospital, on the 19th May, 1847, in a very emaciated condition. His skin was dry and scaly; gums spongy and scorbutic; and he likewise suffered from diarrhœa, which attacked him at the time he was leaving China. He complained

of constant and severe pain over the epigastric region, and along the course of the urethra. He was unable to retain his urine, which constantly flowed from him in small quantities. On introducing a sound into the bladder, a large stone, supposed to be of soft consistence, was at once detected. His general health having considerably improved, and the diarrhœa having, in a great measure, been checked, the lateral operation of lithotomy was performed by me. The patient had a favorable recovery. The man was not aware of a portion of cane having been driven into the bladder, nor was this circumstance known when the operation was commenced. No. 2004.—Portion of cane, being part of the stem of a tobacco pipe, removed from the bladder by the operation of lithotomy. It is three and three quarter inches in length, and hollow in the centre, and was completely imbedded in the centre of a soft stone; the portions extracted must have weighed about two ounces; the fragments preserved weighed one ounce, and are composed of uric acid.

CHAPTER XI.

GUNSHOT WOUNDS OF THE UPPER EXTREMITIES.

Simple Flesh Contusions and Wounds.

The nature and treatment of gunshot wounds in general has already been fully described, and I shall now only notice any peculiarities which may be deemed worthy of notice in the different parts of the upper and lower extremities. Slight, 51; severe, 8. Total, 59. Of these 39 were sent to duty; 9 to modified duty; 11 invalided.

All were wounds by musket ball, with the exception of 3 by round shot, 2 by shell, and 1 by slugs; 28 were wounded in the shoulder and arm, and 11 in the forearm and hand. The wounds were, with few exceptions, all healed, but in a number of cases there was more or less muscular contraction, and consequent loss of use and power in the arm, resulting from the patients' keeping the wounded limb in one particular position for months. In many cases the arm had become apparently perfectly useless, and in some cases even an incumbrance, so that I have been asked to remove it by amputation. This system of nursing their wounded limbs is brought about by trying at first to save themselves pain on any attempt at motion being made, and also from an idea that if they are invalided for a wound received in action they will be granted a higher pension than for any other disability.

In some the fingers were so contracted, and the nails so long, hard, and horny, resembling claws, that they had produced ulceration in the palm of the hand; to remedy this, the bath-man was supplied with a pair of strong scissors to keep the fingers of such patients in proper order.

In others the elbow-joint was contracted, distorted, and

perfectly firm and rigid, and in a semi-bent position, and the fingers powerless from want of use.

The mode adopted for these contractions was simple, and consisted in forcible extension, the patient at the time being generally under the influence of chloroform; strong, straight splints of different sizes were used; they were well padded, and covered with linen firmly sewed down. Before applying the splint, the arm was bandaged with a flannel roller, and the splints, as stated, were strong and of a good breadth, and also of such length as to extend beyond the bones included in the contraction. For instance, when the elbow-joint is contracted, the splint should extend from the fingers beyond the shoulder so as to afford plenty of leverage and purchase, as a very considerable degree of force has to be used. These splints were used almost daily on different patients, and with great success. The number of cases in which perfect cures were effected was great, and in others the condition of the limb was much improved. In none was there any serious injury or bad effect resulting from this process. Occasionally a considerable amount of inflammation and swelling follows, with vesication of the integuments; this always subsides under cold applications, and if the limb should again become contracted, the splint should be reapplied as soon as possible. In some cases a single application of the splint sufficed to straighten the contracted part, but more frequently the splint had to be applied several times, at intervals of a day or two. Sometimes the pain is so great that the patient cannot bear the application of the splint for more than a few hours. He ought, however, to be induced to keep it on as long as possible.

Severe cases are often produced by round shot, causing laceration and destruction of soft parts; these wounds are also frequently followed by sloughing, whether resulting from musket, shell, or any other missile.

With Contusion and partial Fracture of Long Bones, including partial Fracture of the Clavicle and Scapula.

In some cases the ball enters through the fold of the axilla, and passes directly through the scapula. In others the ball

enters above the clavicle, and passes through the superior angle of the scapula; occasionally the ball injures both scapulæ, passing from side to side: in another the ball may go between the scapula and ribs.

Partial fracture of a long bone is generally followed by necrosis, and the results are well exemplified in the case of Private John Lloyd, detailed below.

Under this head 50 were admitted, of which 19 were sent to duty; 8 to modified duty; 22 invalided; 1 died of pyemia.

All were produced by musket ball, with the exception of 1 by a piece of a shell. 14 were injuries of the scapula; 4 of the clavicle; 6 of the humerus; 3 of the radius; and 3 of the ulna.

Of the 14 cases of partial fracture of the *scapula*, 6 were sent to duty; 2 to modified duty; 6 invalided.

Of the 4 cases of partial fracture of the *clavicle*, 2 have been sent to duty; 2 invalided in consequence of loss of power in right arm: in this case the aperture of entrance was healed on arrival here, but that of exit was still open, and led down to bare bone in the clavicle.

Of the 6 cases of partial fracture of the *humerus*, all occurred in the shaft of the bone; 1, as already stated, died of pyemia. This case of Private John Lloyd is interesting, as illustrating (Preparation No. 3629, see Plate VI, fig. 1) the appearance of a partial fracture or indentation of a long bone, caused by a musket ball, which was followed by necrosis of the part injured, while the remaining portion of the thickness of the shaft still continues intact; also the wound remaining open and suppurating, rendering the patient liable to blood-poisoning by the absorption of pus. 9th Lancers.—Private John Lloyd, wounded at Delhi, August 12th, 1857, by a musket ball in the right shoulder, which passed through on the inner side of the humerus, and made its exit on the posterior side of the arm. Both wounds healed before leaving India, but broke out on board ship. August 2nd, 1858.—The aperture of entrance is large, about an inch in diameter, and discharges freely. General health is indifferent and of a scorbutic tendency. 5th.—He complained of dyspnœa; the wound looked sluggish; tongue coated; gums spongy; suffered from pains in the back and loins, especially in the right

hypochondriac region. 7th.—The dyspnœa had increased, and his cough was troublesome; the sputa were purulent, and very tenacious; on applying the stethoscope to the chest, mucous râles could be heard masking the heart's sounds; pain in the right side; pulse small and quick; epistaxis was so considerable as to weaken him greatly; slight diarrhœa. 9th.—He still suffers from diarrhœa; very restless at night, seems to be in every respect worse. 10th.—Complains greatly of pain in the right side; appetite very bad; suffers much from vomiting. 11th.—Bowels not open to-day; his face looks anxious; eyes sunken; pulse very weak and quick; appetite entirely gone. 12th.—Bowels not open for forty-eight hours; is getting very low; complains greatly of pain in the left side; expectoration thick and purulent. 13th.—Died. *Sectio Cadaveris, twenty hours after.—External Appearances.* The aperture of entrance of ball, about an inch in diameter, was observed to be situated on the front of the right shoulder, and on inserting a probe it was found to proceed backwards, between the upper part of the shaft of the humerus and the large vessels and nerves of the axilla, none of which were injured, and passed as far back as the integuments on the posterior fold of the axilla, where the aperture of exit was seen to be closed. The track of the ball was of a dark colour, and in a sloughing state, and contained three small pieces of necrosed bone. A portion of the shaft of the humerus, on its inner side, about two inches below its tuberosity, was bare, and denuded of periosteum, and carious. There is also a depression in this situation from loss of bony structure, where the ball had caused a partial fracture, No. 3629. *Cranium.* Membranes of brain much congested; the brain otherwise healthy. *Thorax.* There were five ounces of serum in the pericardium; heart healthy. The mucous membrane of the larynx, trachea, and bronchial tubes, as far as it could be traced into the lungs, of a deep purple colour, and highly congested; the right pleural cavity free from adhesions; the left pleural cavity slightly connected to the walls of the chest from recently effused lymph, a thin coating of which covered the inferior lobe. On making a section of the lungs, they were found œdematous; several small sacs, the size of a bean, containing deposits of pus, were found in the structure of

the inferior lobe of the left lung, and the surrounding substance was somewhat condensed. *Abdomen.* The liver was much enlarged, and of a dark colour, the structure being otherwise healthy; the gall-bladder was filled with a thin watery bile. The spleen was also greatly enlarged, the structure being soft and easily broken up. The kidneys were very much enlarged, and presented the appearance of granular degeneration in the second stage, some of the tubular portions having disappeared. The stomach and intestines were slightly congested, and of a dark slate colour from a carbonaceous deposit.

Of the 3 cases of partial fracture of the *ulna*, 2 have been sent to duty, and 1 to modified duty; 2 were in the shaft of the bone, 1 by a piece of shell, close to the elbow-joint, resulting in anchylosis.

61st Regiment.—Edwin Carter, æt. 37, wounded at Delhi, September 15th, 1857, by a piece of shell, which struck the inner side of the right elbow-joint, a little below the olecranon, injuring the bone in the vicinity of the joint, without producing rupture of the skin; considerable pain and swelling of the joint ensued, which were relieved by incisions, giving exit to a large quantity of pus. One large piece of bone came away. The wound did not heal for five months. September 5th. —Wound healed; forearm in a semi-bent position, and elbow-joint completely anchylosed. October, 1858.—Modified duty.

One case of partial fracture of the *radius* was sent to duty.

Simple Fracture of the Long Bones by Contusion from Round Shot

May occur in any of the bones of the superior extremity, and may be the cause of abscesses, necrosis, &c., in the parts injured.

Three were admitted; one sent to duty, and two invalided; one was a case of simple fracture of the ulna, with contusion of the wrist, followed by abscesses in the hand; the other was a case of fracture of the clavicle, still ununited, with loss of pulsation and diminished temperature in the injured arm.

32nd Regiment.—Private James Bailey, wounded at Lucknow, September 2nd, 1857, by a round shot, on the left side of the chest, breaking the first and second ribs, and centre of left clavicle, also contusing the shoulder. July 13th, 1858.—The fracture of the clavicle is still ununited; has lost power in the arm, and cannot use the fingers; no pulse can be felt at the wrist, and the left arm is of a lower temperature than the right. August 5th.—Invalided.

Compound Fracture of the Bones of the Superior Extremity.

Necrosis is not so frequent a result of gunshot fracture of the upper as of the lower extremity.

Scapula.—Fractures of the scapula are not dangerous, unless they shatter the neck of the bone, or cause a fissure into the joint. Abscesses are apt to form under the fascia of the back, and require to be laid freely open by incision.

Clavicle.—The clavicle is frequently fractured, and sometimes comminuted, and large portions are either taken away at the time, or long after, on account of necrosis; the brachial plexus of nerves and the large vessels in the immediate vicinity are also often injured, causing paralysis and diminished temperature of the superior extremity.

Humerus.—Gunshot fractures of the shaft of the humerus are generally of such a severe character as ultimately to incapacitate the patient from the duties of a soldier. When the fracture takes place through the head or condyle of the humerus, anchylosis of the neighbouring joint is very liable to take place; and great muscular contraction and rigidity of the tendons and ligaments is usually the result, and the fingers become bent and contracted (if proper care is not observed during the cure), requiring forcible extension to ameliorate their condition, and occasionally to effect a cure. In compound fractures of the upper extremity, primary amputation is never resorted to except in very severe and hopeless cases of gunshot wounds. In some cases the fracture remains ununited, and requires surgical interference to effect a cure.

23 were admitted under this head. 6 were sent to modified duty; 17 were invalided. 1 was caused by a piece of a shell, and the others by musket ball. All were fractured in the shaft of the bone, with two exceptions; 1 of them was through the head of the humerus—anchylosis of the shoulder-joint resulted; the other was through the surgical neck of the bone; 1 only remained unhealed on arrival here.

The following is a case of complete fracture of the humerus, with the ball lodged in the bone below the brachial artery. 53rd Regiment.—Private Patrick Radding, æt. 29, wounded, November 1st, 1857, by a musket ball, which entered on the outer side of the left humerus, about two inches above the elbow, and appears to have passed through the bone to the inner side, where it still remains imbedded in the bone; several pieces of bone have come away. June 11th, 1858.—There is now a firm, hard substance on the inner side under the brachial artery, and he cannot straighten the arm in consequence of contraction of the biceps; there is a deep depression at the entrance of the ball. As the ball did not cause much annoyance, it was not considered advisable to cut down upon it, and remove it, particularly as the man was averse to the operation. August 26th.—Invalided.

The next is a case of fracture of the surgical neck of the humerus, the shoulder-joint remaining sound. 78th Regiment.—Private George Mathews, wounded at Lucknow, September 25th, 1857, by a musket ball, which entered in front of the left shoulder, through the anterior fold of the axilla, passing directly backwards, and came out at the posterior surface of the arm at the posterior margin of the deltoid behind the joint, causing a comminuted fracture at the surgical neck of the humerus; profuse suppuration ensued; several fragments of bone have come away. July 11th.—Apertures of entrance and exit of ball remain open; small pieces of bare bone can be felt; there is some enlargement of the bone at the seat of injury from deposition of new bone. The shoulder-joint is apparently sound, although he cannot move the arm, but he has perfect use of the forearm and hand.

The following is a case where the ball passed through the head of the humerus, followed by abscesses and anchylosis of

the shoulder-joint. 75th Regiment.—Corporal John Ryan, æt. 31, wounded at Delhi, August 12th, 1857, by a musket ball, which entered the head of the left humerus, and passed out about two inches from the spinous process of the vertebra, between the seventh and eighth ribs; stated that he spat up blood for three weeks after; abscesses formed, and numerous pieces of bone came away from the shoulder. July 20th, 1858. —Wound healed; shoulder-joint anchylosed. It is not certain whether the lung was wounded or not. October 6th, 1858.—Invalided.

Ununited fracture.—The following is a case of ununited fracture of the humerus, from India, in an officer.—Major M— had his right humerus severely shattered in its middle third by a musket ball, in June, 1858, at Juydespore; the shot was fired by a Sepoy, who was within a few yards of him. Several pieces of bone came away at the time, and since then a considerable number of small pieces. March, 1859.—There is now a space of about two inches between the ends of the bones, no union having taken place, and there is a slight discharge from a sinus which remains open. There still appears to be some necrosed portions of bone to come away; and it is not thought advisable at the present time to perform any operation with the view of effecting union.

No. 2924.—Shows deficiency of a large portion of the lower part of the shaft of the humerus, from necrosis, in consequence of gunshot wound.

No. 2925.—Humerus, the shaft of which has been shattered by gunshot, and firmly consolidated by osseous matter; a large splinter, which was completely detached, has become perfectly united to the shaft. From Patrick Waldron, 87th Regiment, who received a fracture of the arm in the Burmese war. The ball entered between the outer edge of the biceps and insertion of the deltoid, passed through the os humeri and triceps, and made its exit on the inner side of the arm. The power of the limb was never restored; he subsequently died of apoplexy. When the arm was examined after death the radial nerve was found to have been wounded, and at the injured part was converted into a cartilaginous substance.

Radius.—When the wound is close to the joint, anchylosis is

almost certain to follow. Occasionally there is great comminution of bone and loss of substance. In some instances as much as two or three inches of the shaft may be removed, on account of splinters or necrosis, and, in these cases, there is eventually more or less contraction of the fingers and consequent impaired use of the forearm and hand, so as to render the men unfit for service. Occasionally the fracture remains ununited, although the ends of the bone are in contact; sometimes the ball is supposed to be lodged and impacted in the bone, and when cut down upon, cannot be found. Ligature of the radial artery may be required to be performed either immediately after the wound, or on account of sloughing.

The following is a case of fracture of the radius, with probable injury of the median nerve. 88th Regiment.—Private Robert Buchanan, æt. 20, wounded November 26th, 1857, by a musket ball, which entered on the anterior surface of the forearm, about three inches below the elbow-joint, and passed out on the posterior surface, opposite to the place of entrance; the radius was fractured, and several pieces of bone have come away; the median nerve has also, probably, been wounded. July 11th, 1858.—He has now completely lost the power of motion and sensation in the hand, which hangs powerless by the side, and the lower extremity of the ulna projects as if the hand was partly dislocated. July 31st.—Invalided.

The next case is one of severe comminution, with loss of about two and a half inches of the shaft of the bone. 60th Rifles (1st Battalion).—Private John Kerr, æt. 19, wounded at Delhi, June 14th, 1857, by a musket ball, causing a compound comminuted fracture of the right radius about its middle, doing also much injury to the flexor tendons; several pieces of bone were taken away at the time. July 20th, 1858.—Wound healed; there is loss of a portion of the shaft of the radius for about two and a half inches; he cannot use the fingers, or pronate or supinate the hand. July 21st.—Invalided.

No. 2926.—Radius, the shaft of which has been fractured by a gunshot, and reunited by new osseous matter, and firmly consolidated thereby to the ulna.

Ulna.—The same injuries are liable to take place to the ulna as to the radius, and occasionally ligature of the radial or ulnar

artery is required to be performed, on account of sloughing; an example of which is detailed under Ligature of Arteries.

Radius and Ulna.—The same remarks are applicable to fractures of both bones of the forearm, as to fracture of either of them separately, except that when both bones are fractured, the injury must be looked upon as much more severe.

Penetrating, Perforating, or Lacerating the several Structures of the Carpus and Metacarpus.

The proportion invalided in these injuries is usually great, which shows their severity, In some cases the ball completely perforates the carpus or metacarpus; in others it strikes the bone in a slanting direction and passes out, producing more or less injury to the bones, tendons, and ligaments, so that in every case there is contraction and rigidity of parts, with distortion, want of power, and otherwise impaired use of the hand and fingers resulting. Whenever it is requisite, forcible extension should be resorted to. The wrist and phalangeal joints are frequently anchylosed as a result of these injuries.

In the following case the ball still remained in the fleshy part between the thumb and forefinger, and it was not thought expedient to cut down upon it and remove it, in consequence of its not producing much inconvenience, and also from the patient objecting to the operation, fearing that he might be attacked with lock-jaw, and especially as he was otherwise strong and healthy. 60th Rifles (1st Battalion).—Corporal Denis Bergin, æt. 30, wounded at Delhi, July 15th, 1857, by a musket ball, which had entered on the posterior surface of the left arm, about two inches above the wrist, passed between the radius and ulna, and made its exit on the anterior surface of the forearm. On July 14th he received another wound from a musket ball in the left hand; the ball entered on the posterior surface between the thumb and forefinger, and still remains in. July 20th, 1858.—Wounds healed; has lost considerable power of the finger, and the wrist-joint is anchylosed; the ball is felt between the thumb and forefinger. 21st.—Invalided.

84th Regiment.—Private Thomas Rushworth, æt. 28, wounded at Lucknow, November 17th, 1857, by a musket ball, in the left wrist, which entered on the front nearly in the centre, passed directly through, and made its exit on the posterior side; several pieces of the carpal bones were removed at the time, and great swelling of the hand ensued. August 16th, 1858.—Wounds healed; there is anchylosis of the wrist-joint, with impaired use of the hand. September 2nd.—Sent to modified duty.

CHAPTER XII.

GUNSHOT WOUNDS OF THE LOWER EXTREMITIES.

Simple Flesh Contusions and Wounds.

The treatment of these wounds in the lower is the same as in the upper extremities, but as an example of their frequency, &c., the following results will show.

Slight, 117; severe, 13; total, 130.

Of the total 130 cases, 90 were sent to duty; 15 to modified duty; 25 invalided.

On comparing the number of gunshot wounds of the upper with that of the lower extremities, it will be noticed that they are very nearly the same, viz., 212 in the upper, and 234 in the lower. There is, however, a considerable difference as to the number of flesh gunshot wounds, there being 130 in the lower, and only 59 in the upper extremities. 5 were shell wounds; 8 by grape shot; 1 by a brickbat; 1 by a rifle ball; and the remainder by musket ball. 12 were wounded in the hip; 26 in the thigh; and 62 in the leg. In 2 cases balls were extracted from the fleshy part of the thigh, at Fort Pitt; and in another case from the perinæum, immediately over the bulb of the urethra, the ball having entered on the outer side of the thigh, opposite the trochanter major; in 3 cases the wounds were very close to the femoral artery; and in 1 the ball still remains in the thigh. This man is returned under "Amputation of the Finger," but the other wound is interesting, and is noticed in this place; the ball must have grazed the femoral artery and vein; on inserting a probe into the fistulous opening, the ball could be distinctly felt deep behind the artery. Of the 13 severe cases, 1 was by a ball which is lodged in the tuberosity of the ischium; 2 were from round shot in the thigh, followed by sloughing; several were ball and shell wounds in

the thigh, followed by sloughing; 1 was by a rifle ball in the thigh; 1 by a ball in the thigh close to the femoral artery, injuring the sciatic nerve; and in 5 cases the wounds were from balls in the fleshy parts of the leg, followed by sloughing.

In a number of cases there was great contraction and rigidity of the hamstring muscles and ligaments around the knee-joint, also in the muscles of the calf, and around the ankle-joint, requiring forcible extension. Many of them, on arrival, walked with crutches, the leg suspended in slings, and the foot pushed out behind; the crutches were taken from them, and the limbs placed in splints and extended; and with the same results as in the upper extremity, the greater number being much improved in condition, and several perfectly cured.

The very indolent character of open sores after gunshot wounds is worthy of remark. The men were apparently in good health, had lived well both in India and on board ship, and were generally untainted with scurvy; still, the ulcers resisted every mode of treatment,—lotions of every description, blisters, strapping, incisions, filling them with wax, &c.,—nothing would induce granulations or a healthy action.

The following is a case where a ball entered posteriorly in the centre of the buttocks, and lodged in or near the pubis; the ball could not be felt by the finger from the perineum, but it was detected by the long probe through the aperture in the hip. 10th Regiment.—Private John Ferguson, wounded at Benares, June 4th, 1857, by a musket ball, which entered the centre of the right buttock, and passed forwards and downwards, and is now lodged in or near the ramus of the pubes. July 13th.—The aperture of entrance on the centre of the right hip is still open, and the ordinary probe goes in its entire length without feeling any foreign body; the long probe can detect the ball lying near the pubes. July 17th, 1858.—Invalided.

In the following case the ball must have grazed, or at least passed very close to the femoral artery, and lodged deep beneath it. 84th Regiment.—Private Thomas Bulger, æt. 33, wounded at Cawnpore, November 16th, 1857, by a musket ball, which struck him on the left hand, fracturing the first, second, and third fingers, and then passed through the anterior

and outer part of the upper third of the left thigh from behind forwards. Wounded by a second musket ball in the anterior aspect of the left thigh, the ball entering about three inches below Poupart's ligament, close to the course of the femoral artery, where it lodged. Amputation of the fore and middle fingers, between the first and second phalanges, was performed four days after. August 16th.—Covering of stumps of fingers good; motions of ring and little fingers impaired; perforating wound of thigh healed. The wound where the ball is lodged still remains open; there is only a small sinus, through which the ball can be felt, situated close to the inner side of the femoral vein; attempts were made to dilate the wound by tents, as it would have been rather hazardous to cut down upon it, being so very near the femoral artery and vein; the man objected strongly to have an incision made for its removal, and, as the wound had closed, he was discharged the service, October 15th, 1858, on account of loss of fingers by amputation, under which head he is included in the return, although noticed in this place for the wound in the thigh.

With Contusion and partial Fracture of Long Bones, and of the Bones of the Pelvis, in their relation to the Lower Extremities.

50 were admitted, of whom 29 were sent to duty, 6 to modified duty, and 15 invalided. 5 were partial fractures of the ilium, 3 in the thigh, 14 in the tibia, and 5 in the fibula; 13 were caused by ball, 3 by grape, 1 by round shot, and 1 by shell. Of the 5 cases of fracture of the ilium, several were very severe; in 2 the balls were supposed still to remain impacted in the ilium, but causing no inconvenience; in 1 a portion of bone, two inches in diameter, came away by necrosis; of the 3 cases of wounds in the thigh, in 2 of them there was only slight injury to the femur; in the third case the ball entered in the popliteal space, and anchylosis of the knee-joint resulted; of the 14 wounded in the leg, there was 1 where the ball fractured the tibia, with, probably, a split into the ankle-joint; in 1 case sloughing followed, requiring ligature of the posterior tibial artery; in 1 a round shot tore the soft parts

extensively; and in 1 the greater portion of the tibia became necrosed, and was taken away. In a number of cases there was considerable contraction of the knee and leg.

The following is a case where a ball is said to be firmly impacted in the ilium. 10th Regiment.—Private Robert Sherlock, wounded at Benares, June 4th, 1857, by a musket ball, which entered about two inches below the crest of the ilium, and is firmly impacted in the bone, as stated in the document. At a consultation held on November 17th, at Dinapore, it was decided that at present an operation was not advisable. July 12th, 1858.—Wound healed; ball cannot be felt through the soft parts, and it causes no uneasiness or pain to the man. July 13th.—Sent to duty.

The next is a case of fracture of the ilium by grape shot, followed by necrosis. Preparation No. 3627 is the portion of the external table of the ilium, about two inches in diameter, which was removed from the following subject. 88th Regiment. —Private Martin Ford, æt. 20, wounded at Cawnpore, November 26th, 1857, by a grape shot, on the crest of the right ilium, immediately above the anterior and superior spinous process, where it lodged, and was extracted two days after; several pieces of necrosed bones have come away. October 10th, 1858.—Wounds healed; there is a deep adherent cicatrix over the outer side of the hip, with stiffness and contraction of muscles. 15th.—Modified duty.

The following case is an example of a wound near a joint, producing such severe inflammation of the ligamentous structure, and of the joint itself, as to cause anchylosis. This case was placed under this division, as it was thought probable there was more or less injury to the bone, although it was stated in the report of the case that there was not any fracture. 60th Rifles (1st Battalion).—Private Edmund Miller, wounded at Delhi, September 14th, 1857, by a musket ball, which struck the centre of the popliteal space, but, as far as could be observed at the time, not entering the joint or causing any fracture; great swelling and effusion occurred, with considerable disturbance, and excessive pain on moving the limb, or even the mildest manipulation. The ball was extracted with some difficulty from the aperture of entrance, which rapidly healed, and

again broke out. July 20th, 1858.—Left knee anchylosed, but he is still able to walk. 22nd.—Invalided.

The following case shows extensive necrosis of the tibia, which is a frequent result of injury or partial fracture of this bone. 75th Regiment.—Private George Steptoe, wounded at Delhi, September 14th, 1857, by a musket ball in the left leg, which entered immediately below the tubercle of the tibia, and passed out on the outer side of the leg at its upper third; several pieces of bone came away from both wounds. July 20th, 1858. —Exit wound healed, entrance aperture still open, and several other sinuses leading down to necrosed bone; tibia enlarged; integument livid and discoloured. 26th.—Two pieces of bone, about two inches in length, were extracted from the centre of the tibia, at Fort Pitt.

The last case in this division is an example of a longitudinal fracture into the ankle-joint, followed by anchylosis. 5th Regiment.—Private William Burrowes, wounded at Judespore, August 12th, 1857, by a spent musket ball, on the inner side of the right leg, about one inch above the ankle-joint; it was extracted immediately after by pulling out the sock and trowsers, which had been carried in with it; the tibia seems to have been splintered longitudinally into the ankle-joint. September 26th, 1858.—Wound healed; ankle-joint anchylosed; there is a slight depression along the front of the lower third of the tibia; he walks lame. November 21st.—Invalided.

Simple Fracture of Long Bones by contusion of Round Shot.

This is rather a rare accident, but one case was admitted, and is returned under "Amputation of the Leg." (McCrea.)

Compound Fracture of Femur.

13 were admitted from India, of whom 3 were sent to modified duty, 9 invalided, and 1 died. One double fracture —one fracture being at the upper third, and one at the middle third; fracture at the upper third in 4; at the middle third in 6. By musket ball in 7; by round shot in 1; musket ball

Walmsley (death) is very interesting, as showing strong bony union at the trochanter, with the ball lodged between the fractured ends.

Hunter is able to walk about with very little lameness, and the sinus discharges very little. There appears to be a very extensive deposition of new bone, with thickening of the lower third of the femur, and central necrosis; the new bone extends so low as to encroach somewhat on the motions of the knee.

They were all, as far as can be ascertained, treated by the long splint, with the exception of M'Carter and Burke, who used M'Intyre's splint for some time.

The advantage of the *dooley* over the best *constructed ambulance, for the conveyance of sick and wounded over rough roads during active military operations,* is well shown in the result of these cases of compound comminuted fracture of the femur. All regiments in India have a certain proportion of dooleys and dooley-bearers attached to them permanently in the time of peace, and when on the line of march and on active service they are, of course, increased. *Why should not Government enlist and organize in India a corps of trained dooley-bearers for service with our regiments in European wars?*

This appears to me to be a measure which could be carried out without much difficulty, if sufficient inducements as to pay, good treatment when in the service, and the promise of a pension when discharged, and sent back to their homes in India, were held out to them.

In the following case there was extensive laceration of the soft parts, and severe comminution of bone; large portions of necrosed bones were removed. The wound had never entirely healed; the limb was two inches and a quarter shorter than the other. 64th Regiment.—Private William M'Carter, æt. 26, nine years' service, was wounded on February 8th, 1857, at Kooshat, in Persia, by a spent ball, which struck the outer and anterior aspect of the middle third of the right thigh, producing a severe comminuted fracture of the femur, with extensive laceration of the soft parts. The thigh was protected temporarily by a single straight splint on the outside. On the following morning the limb was put on a M'Intyre's splint, with two side splints in addition; considerable inflammation followed, with great swell-

ing and profuse discharge, and constitutional disturbance. He remained in bed until May 6th, when he embarked for Bombay, when the wound was still discharging a good deal. Four large and several smaller pieces of bone have come away at different times; abscesses have frequently formed on the posterior aspect of the thigh; and on one occasion a large piece of bone was removed from it. Fort Pitt, May 4th, 1858.—General health good; fracture firmly united, but the bone is curved outwards; the original wound has never entirely closed, and there are now two sinuses leading down to bare bone. 18th.—The necrosed portion of bone, about one inch in length, was removed; the limb was two and a quarter inches shorter than its fellow; on standing up, the great toe and next one touched the ground, and the heel is raised three and a quarter inches. 29th.—Wounds nearly healed; can bear his weight upon the limb, and walk about, with the aid of a stick, without crutches. On the whole, he has a very useful limb, much preferable to any artificial one. 30th.—Invalided.

In the next case there was a double fracture, both firmly united, the ball still remaining in; the limb is two and a half inches shortened; still, he walks so well that he has been sent to modified duty 64th Regiment.—Private Patrick Carty, æt. 28, wounded at Lucknow by a musket ball, which struck him, while in the erect position, on the right thigh, on its posterior surface, about five inches below the superior spinous process of the ilium; the ball, it is stated, still remains in the thigh. After being wounded he remained at the village of Amoo for three days, with his thigh bound up tightly (he states) with short splints placed round the limb; on the fourth day he was removed to hospital at Cawnpore. Eighteen days after the wound was inflicted he had a long splint put on, and was placed on a hard mattress; he remained in hospital at Cawnpore twenty-four days, and was then carried to Allahabad, the journey occupying eight days; he remained in hospital at Allahabad for one month, and was then conveyed to Calcutta in a steam vessel; he remained in hospital at Calcutta for two months and eight days; the splint was removed after he had been in hospital at Calcutta one month; and on his embarking for England, on January 8th, 1858, he was able to move about tolerably well with the aid of

crutches; he states that during the voyage home he gained strength in the limb very rapidly. June 25th, 1858.—The femur appears to have been fractured in two places; the upper fracture is just below the spot where the ball entered, a projection of a fractured end of the bone is distinctly felt there, and another projection of a fractured end of bone is felt at the outer and middle part of the thigh; there is also a small tumour on the outer side of the thigh, below the strong fascia, which is only movable when the muscles are relaxed: this may, probably, be the ball; the limb is shortened to the extent of two and a half inches; he can now walk for a short distance with very little lameness, without crutches or stick, and states that he does not suffer any pain unless he gets on uneven ground; his general health is good. September 6th, 1858.—Sent to modified duty. December 22nd.—Invalided.

In the two following cases the fracture was in the upper third; the broken limbs were one and a half inches shortened, and they had become nearly as strong as the other legs. 53rd Regiment.—Private John Ashworth, æt. 29, wounded November 1st, 1857, by a musket ball, which entered two inches below the great trochanter, and emerged in the front of the thigh at its upper third, having in its course fractured the bone; the limb is one and a half inches shorter than the other. July 14th, 1858.—Wounds healed; complains of weakness in the limb, but is able to walk about without the assistance of a stick. September 6th.—Sent to modified duty.

52nd Regiment.—Private Joseph Hewitt, æt. 27, wounded July 12th, at Goodispore, by a musket ball, which entered on the anterior aspect of the upper third of the left thigh, and fractured the femur; the ball was cut out in the lower part of the gluteus muscles six weeks after. July 20th, 1858.—Wound healed; the fractured ends of the bones overlap; the leg is now an inch and a half shorter than the other, and he cannot put his heel to the ground. It is a good cure, and he still retains a very useful limb; no pieces of bone came away; long splint used. 22nd.—Invalided.

The following is a case of fracture of the upper third; the ends of the bones overlap considerably; the limb is shortened two and a half inches, and the ball lodged. 75th Regiment.—

Private Edward Collins, wounded at Delhi, June 8th, 1857, by a musket ball, which entered the upper and outer side of the right thigh, and lodged, fracturing the femur; ball extracted; a piece of bone came away. July 20th.—Wound healed; right leg about two and a half inches shorter than left; femur bent; fractured ends of bone overlap, and there is abundant deposition of new bone; the long splint was used. Has a good useful limb, and can walk a long distance. September 6th, 1858.—Sent to modified duty. October 6th.—Invalided by an order from the Horse Guards.

In the next case the fracture is between the middle and lower thirds of the femur; limb shortened one and a half inches. 53rd Regiment.—Private James Burke, wounded at Lucknow, November 16th, 1857, by a musket ball, which entered the front of the left thigh, about the junction of the lower with the middle third, fracturing the femur, and passing inwards and backwards; it was cut out two days after in the inner side of the thigh; no piece of bone came away. Was sent back to Cawnpore in a dooley, and his leg retained in the long splint; went from Cawnpore, in a hackrey, to Allahabad, on the 2nd December, and arrived there on the 10th, and shortly after the limb was put on a double-inclined plane, and finally upon the long splint; was unable to bear his weight on the limb until April, 1858. August 16th.—Wounds healed; the fracture is united, but the ends overlap on the outer side, and the left leg is about one and a half inches shorter than the right; he can bend the knee-joint, and has a very useful limb, being able to walk tolerably well. September 6th.—Sent to modified duty.

The following fatal case shows that it is often impossible to find out by what description of missile the wound is produced, as the document stated that the fracture was caused by a portion of shell, and a ball is seen to be lodged between the united ends of the bones. It also appears that there were two apertures, one of entrance, and one of exit; so that he must have been wounded by two projectiles,—one, the ball, lodged; and the other, probably a portion of shell, perforated the limb. The preparation also shows the state of the parts twelve months after the injury. In such a case as this, excision at the hip

[illegible] *Post-mortem.—Body.* The marks of entrance and exit of a musket ball on the inner and outer side of the upper third of right thigh; the limb was much shortened and distorted to the extent of about three inches, the great toe resting upon the instep of the opposite side. *Thorax.* Heart and lungs both healthy. *Abdomen.* Liver healthy, with the exception of one or two whitened patches on its surface; the lower portion of the large intestines was congested, and the mucous membrane showed marks of old ulceration, the result of chronic dysentery. Preparation No. 3624 (see Plate VI, fig. 2). Right femur, showing a comminuted fracture of the upper third, immediately below the trochanter; the fracture extends from the great trochanter obliquely, downwards and inwards, for an inch below the smaller trochanter; the extremity of the lower end of the fractured bone is on a level with the great trochanter; the extremities of the fractured ends of the bones are very firmly united by extensive depositions of new bone, and there is a large cavity between the ends, in which there is a round musket ball, and a large aperture leading to it on the outer side, where it entered; on this side there is also a large irregular lamina of neoformed bone.

The last is a case of fracture between the middle and lower thirds, followed by necrosis, and extensive deposition of new bone so as, in some measure, to impede the motion of the knee-joint 83rd Regiment. Private Samuel Hunter, æt. 24, wounded

Fig 1.

3629

Fig 2.

3624

Fig 3.

2936

Fig 4

2937

Fig 2 a. Ball lodged. b. Portion of necrosed bone.

at Lucknow, November 1st, 1857, by a musket ball, which struck the outer side of the left thigh, at the juncture of the middle and lower third, fracturing the femur, and passed out on the inner side; a number of pieces of necrosed bone have come away. Was sent in a dooley to Futtehpore, where he remained nine days; the limb being placed in a short splint along both sides; was then sent by dooley to Allahabad, where the long splint was applied, and retained four months. September 25th, 1858.—Aperture of entrance and exit healed; there is a sinus on the outer and posterior aspect of the middle and lower third of the thigh, through one of which bone can be detected; the left leg is one inch shorter than the other, and there is great deposition of callus around the fractured ends of the bone, which have been considerably displaced. September 26th.—Invalided.

The three following preparations, Nos. 2936, page 145, 2937, page 146, 2938, page 147, where the patients survived for many months, show the great amount of comminution which takes place even from the old ball, and the amount of distortion which unavoidably ensues from the impossibility of keeping up the requisite degree of extension, with the consequent necrosis of portions of bone, and the large quantity of callus which is thrown out. No. 2936 shows that the inflammation must have extended to the knee-joint, the patella having become anchylosed to the femur, with absorption of the cartilages. In No. 2937 there are several large portions of bone, dead, and in process of separation. No. 2938 shows an immense large comminuted portion lying behind, with very great displacement and shortening, with very profuse depositions of new osseous matter.

The preparations Nos. 2936 and 2938 were from patients who were wounded at Ferozeshah. No. 2936 (see Plate VI, fig. 3). Comminuted fracture at the middle and lower third of the left femur, from gunshot. The bone is much distorted, and the lower portion is turned inwards; there is a large fragment lying in the posterior aspect, and the fractured extremities are united by a very abundant deposition of new osseous matter, in the centre of which are two portions of necrosed bone, firmly attached to the new bony matter. The patella is anchylosed to the femur, and the cartilage on the latter is absorbed. The patient

died twelve months after the accident, from pneumonia. Taken from Private James Hewitt, 29th Regiment, æt. 25; seven years' service, of which four years in India; received a gunshot wound at Ferozepore, December 21st, 1845; the ball passed through the left thigh, fracturing the femur, and lodged in the right, from which it was extracted. Admitted into Fort Pitt General Hospital, September 28th, 1846. There were two depressions on the left thigh. On October 7th erysipelas attacked this thigh; on the 11th, incisions were made on its inner side, from which a piece of exfoliated bone was extracted. From this date to the beginning of November the erysipelas had gradually extended to the foot, and had given rise to great constitutional disturbance. Openings were at different times made to give exit to large quantities of pus. There was shortening of the limb to the extent of four and a half inches, and four openings in the thigh, one on the outer side, through which the probe reached the bone in a denuded state. December 27th.—He was attacked with acute pain in the left side, at the lower border of the true ribs, accompanied by cough and difficulty of breathing. Expectoration not coloured; on the left side there was dulness, and coarse crepitation heard. He gradually became weaker, and died January 2nd, 1847. *Sectio Cadaveris.—External Appearances.* Body much emaciated; left leg much swollen, and four and a half inches shorter than the other; on making an incision into the affected limb, the sub-cutaneous fat and areolar tissue were thickened, and infiltrated with serum; on laying open the outer sinus there issued a large quantity of dark-coloured pus; underneath this opening, and lying close upon the bone, was found the flattened remains of a musket ball. The left pleural cavity contained two ounces of turbid serum, in which were floating flakes and masses of lymph; the pulmonary and costal pleura was highly vascular, and coated with a recent layer of lymph, which was easily detached. The lower lobe was condensed, and sank in water; a section presented the usual appearance of gray hepatization, softened and broke down, and infiltrated with pus. Right lung healthy.

No. 2937 (see Plate VI, fig 4). Gunshot fracture of the left thigh. The ends of the bones are very much displaced,

but united by new bony deposit, which forms a large cavity; the end of the lower portion of the femur is necrosed and in progress of being separated; there are also several other portions of necrosed bone, either partially separated or bound down by the new bone; a comminuted portion of bone is situated on the outside, attached to the others by bony union.

No. 2938 (see Plate VII, fig. 3). Lower part of the right femur, showing an extensive comminuted fracture from gunshot. The broken ends are much displaced; the lower portion lies to the inner side of the upper, having been drawn upwards and inwards by the action of the muscles; the limb must have been shortened to the extent of three or four inches; there is a large fragment at the posterior part of the preparation, which is united to the two fractured ends, but particularly to the lower portion, by a very abundant deposition of new osseous matter; there is a large cavity between the posterior fragment and the lower portion of the femur; the upper extremity of the fracture lies to the outer side of the lower, the extreme end of which is sharp and pointed, having been fractured obliquely, and, probably, protruded through the skin. From an officer who received compound fracture of the thigh from gunshot, at Ferozeshah, and afterwards died of phthisis pulmonalis.

The preparation No. 2939 is a good specimen of ununited fracture at the middle of the femur, and shows the amount of comminution which follows from *two* conical balls, and also the deteriorated state of the patient's constitution, very little callus having been thrown out. The bone in this case is not nearly so extensively comminuted as in preparations Nos. 2936, page 145, 2937, page 146, and 2938, page 147, which were produced by the old round ball. This specimen is also an excellent example, showing the care which is requisite in examining gunshot wounds, either before inflammation has set in, or when operative measures have become necessary. In this case *two* minie balls had entered the limb; one of them was loosened by the suppurative process, and was extracted, and the other was found, on post-mortem examination, lying between the ends of the ununited fracture. The ball is also seen to be enclosed between the ends of the united fractures in the case of Walmsley, page 143. The same has been noticed in the 'Report on the Wounded from the

Crimea,' p. 362. No. 2939 (see Plate VII, fig. 1).—Gunshot fracture in the centre of the right femur; bone much comminuted, and the extremities ununited and overlapping. The comminuted pieces are united by new bony deposit, and there are also several portions necrosed. Taken from Peter M'Donald, 42nd Highlanders, who was wounded on the Alma by a musket shot, and sent to Scutari, when he was much reduced in strength, and the limb very much swelled and discharging freely. After some time a musket ball was discovered and removed; the swelling reduced, the sinuses closed, and he was enabled to move about with crutches. About a week after, the limb again swelled, irritative fever ensued, and the man died. On examining the limb, another minie ball was found in the cavity between the ends of the bones, chiefly covered by ligamentous and bony matter.

When a bone has sustained an injury so as to cause a slight superficial exfoliation, this is generally quickly thrown off, but when necrosis of half the circumference, or even of the whole thickness of the shaft of a long bone, takes place, inflammation and suppuration to a greater or less extent ensue, and new bone is thrown out, which encloses the dead or dying bone. During the time these fragments are being detached, the patients are more exposed to the absorption of pus, and consequently death from pyæmia.

The following preparations, Nos. 2934 and 2935, and also that of Private Hunter, from India, are excellent examples of necrosis following these injuries, especially No. 2934, where nearly the whole of the shaft of the bone is dead, and enclosed in a new osseous case. It appears to have been the result of a severe injury to the bone, but without producing a complete fracture.

No. 2934 (see Plate VII, fig. 2).—Femur presenting necrosis of its shaft. The sequestrum comprehends the entire thickness and nearly the whole length of the shaft, and is very rough on the surface. It is detached, and surrounded by a thick, uneven shell of new bone, abundantly pierced by cloacæ, so as to expose the dead part extensively. From a man admitted with a gunshot wound of two years' standing; the ball had lodged, but had been cut out a month afterwards. On

Fig 2
2934

Fig 1
2939

Fig 3
2938

Fig 4
2947

Fig 4

2933

Fig 3

2930

admission there were two openings between the hamstrings; his general health was very bad, and he died after ten weeks' treatment.

No. 2935.—Lower half of the femur, exhibiting necrosis of the anterior circumference of its shaft. The sequestrum is rough on the surface, and loosely contained in a cavity, formed by an abundant deposit of new bone, which is pierced by numerous foramina. From a gunshot injury.

The preparation No. 2941 shows a gunshot fracture of the lower third of the femur, which is fractured obliquely, and comminuted; a portion is driven into the medullary canal. The margin of both fragments shows the action of the absorbents; there is a line marking the portion of bone in process of separation, and partly necrosed along the margin of the fracture. Secondary amputation was performed at the upper third.

The preparation No. 2931 (Plate VIII, fig. 1) is an example of a round leaden bullet, producing an oblique fracture through the great trochanter, and becoming firmly imbedded in the cancellous structure of this tuberosity.

An illustration of a grape shot lodging in bone without splintering, or even causing a fissure, is No. 2932 (see Plate VIII, fig. 2), where there is a cavity at the base of the great trochanter, containing a grape shot, which is quite loose, the cavity being considerably larger than the ball.

Five cases were admitted after March, 1859, of which the following are the detailed histories:—

In the first case, it is impossible at the present time, now nineteen months after the injury, for a surgeon to say whether immediate amputation ought to have been performed, but it appears to testify to the great advantages and superiority of the dooley over every other means of conveyance for cases of gunshot fracture of the femur; as there can be no question that this patient could not have survived such repeated removals by any other method of conveyance.

8th Regiment (1st Battalion).—Private William Cunningham, æt. 31, on the 14th September, 1857, at Delhi, in the trenches, received a gunshot comminuted fracture of the left femur; the ball entered on the outer aspect, some seven and a half inches below the trochanter, and has never been found. He states that

he was at once placed in a dooley, and the limb shortly after put up in a long splint; was twice moved to different houses which were set apart as hospitals at Delhi, and at the expiration of three months he was sent to Umballa in a dooley, a distance of eleven days' march, without any splint, the bone still ununited; and, according to the patient's statement, the splint never was replaced. The upper fragment of the femur projected in front, and protruded through the integuments, and a portion came away by necrosis; extensive abscesses formed, and the limb was left perfectly free of any apparatus, as the patient was in such a weak and exhausted condition that it was not expected he would survive; and it was thought that he was not capable of bearing amputation of the limb. He states, that while at Umballa the fracture united, and after being there two months he was sent to the Hill Station at Landaur, in a dooley. Fort Pitt, 27th April, 1859.—The outer fragment projects outwards and forwards, and is covered by integuments; the limb is 4¾ inches shorter than the opposite one; the toes are pointed downwards, and the limb wasted. There is an open sinus at the seat of the fracture, which extends deep below the fragments, although bare bone cannot be felt. The knee-joint is stiff, and ligamentous structure rigid from want of use, but the leg is in a straight position. 20th May.—The sinus has healed, and the patient can bear his weight upon the limb. He has been fitted with a high-heeled boot with a long thigh-piece, &c., attached, by means of which apparatus he is able to walk tolerably well, with the assistance of a stick. Invalided May, 1859.

53rd Regiment.—Private Samuel Shaw, æt. 36, was wounded February 3rd, 1858, near Lucknow, by a musket ball, which entered the outer side of left thigh, about 4 inches above the knee, fractured the femur, made its exit on the inner side, and then entered the opposite thigh, whence it was removed by incision from near the patella. May, 1859.—Left thigh 1½ inch shorter than the opposite, and much atrophied, with two cicatrices adherent to the bone; the wound has only very lately healed, and the knee is stiff; he has a very useful limb, and is able to walk well with a high-heeled shoe. Invalided 13th June, 1859.

1st Battalion 24th Regiment.—Private George Williams, aged 29; ten years' service; wounded at Umritzir on the 18th October, 1857, by a musket ball, which entered the right groin a little external to the vessels, and came out just posterior to the great trochanter, fracturing the femur; many fragments of bone came away from the opening. June, 1859.—Aperture of entrance and exit healed, but leg shortened one and a half inches; a sinus exists on the outer side of the hip, leading down to diseased bone; has just recovered from an attack of erysipelas of this thigh; the right leg is one and a half inches shortened; there is every prospect of the patient having a very good and useful limb; he is able to walk about upon it, with the assistance of a stick. Invalided 29th June, 1859.

86th Regiment.—Private J. Curtis, aged 35; fourteen years' service; wounded November 23rd, 1857, at Mendeswor, by a musket ball, which entered three inches below and a little internal to the anterior superior spinous process of the ilium, and made exit over the trochanter. June 28th, 1859.—Fracture of the left femur at its upper third; bone united; limb three and a quarter inches shortened; some loose, dead bone can be felt through the unhealed wound of exit; has now a very good, useful limb, and can walk well. June 29th, 1859.—Invalided.

This makes 12 undoubted cases of compound comminuted fracture of the femur that have arrived in England during the whole period included in this Report. Of these, 1 died at Gravesend (Walmsley), and 1 (Cunningham) where the cure is complete, but there is considerable deformity of the limb: deducting the death, there remain 11 cases with good, useful limbs out of the total landed, viz., 743, or 1·49 per cent. This is a large proportion compared with the results of the Crimean war, viz., 8 out of 2296, or 0·34 per cent.; and if the case of Moore, which is detailed below, was returned under this head, there would be a total of 13 cases.*

When the bones of the leg are fractured so as to require im-

* Four cases of gunshot wounds arrived from the war in Persia, all belonging to the 64th Regiment; on the termination of this war the 64th Regiment sailed for Calcutta, and formed part of the force under General Havelock in his advance on Cawnpore and Lucknow. These four cases, although actually wounded in Persia, are included in this return as from the mutiny in India; and one of them, M'Carter, is a case of compound comminuted fracture of the femur.

mediate amputation, this operation will, in all probability, have to be performed in the thigh. If, therefore, a certain number of thigh amputations are admitted, it may be inferred that the greater number had been originally wounds of the leg, and not cases of compound fracture of the femur demanding amputation.

15 amputations of the thigh have arrived from India; of which 14 are returned as in the middle third, and 1 in the upper, of the total 842 wounded. As stated in the Preface, the success of the cases from India with this description of fracture is not to be imputed to the difference of the bullets, but to the better means at hand for treating both compound fractures of the femur and amputations. It also appears to be the better practice not to be overanxious about the length of the limb, but rather to leave it almost entirely without splints.

In the following case there appears to be some doubt as to whether the femur was actually fractured, or whether it was only a partial fracture; although, from the direction of the ball and the state of the limb since the injury, there is strong presumptive evidence that there was a complete fracture, either through the neck of the bone or through the trochanter, but without displacement, as now there is almost no shortening, not more, or perhaps so much, as half an inch. This man is, therefore, returned under Class IX, Division 2, but his case is detailed in this place. Of the 12 cases returned there can be no doubt that the femur was fractured.

24th Regiment.—Private James Moore, aged 33, thirteen years' service, was wounded by a musket ball on July 7th, 1857, at Jhelum, which entered the left groin, about two inches below Poupart's ligament, and about two and a half inches external to the femoral artery, and passed out an inch and a half behind, and a little below the great trochanter, injuring the bone. Fragments of bone have continued at various times to come away. He has been at Gravesend since August, 1858, since which no dead bone has come away, but "he has had a pretty regular monthly accession of ague," with hepatic complication, lasting for a few days, and followed by formation of matter in the seat of the wound; and sinuses, which have re-opened, discharge for a short time, and then quite heal up, to break out again on the next disturbance of the general health. There is

now considerable phlegmonous inflammation around the wound and whole of upper part of thigh, and necrosed bone exists in considerable quantity. General health good. November, 1859. I have fully satisfied myself that this was an instance of gunshot fracture of the upper part of the femur. The upper part of the thigh and buttock have now become much consolidated; and although a sinus in the buttock remains open and leads to a fragment of dead bone, which is not yet loose (although the wound was inflicted in July, 1857), the parts are in a quiescent state, and the man, having been fitted with a high-heeled boot, is able to get about with facility by the help of a stick, and is now in good health and free from the ague from which he formerly suffered so severely.

Private John Gerry, 2nd Battalion 60th, aged 19, was wounded at Nonee, 21st October, 1858, by a musket ball, which entered at the middle third, on the inner side of the left thigh, apparently passed behind the artery, fractured the femur at the junction of the upper and middle thirds, and was cut out at the back of the thigh six months after; two fragments of bones were subsequently removed from that opening, which healed, but the entrance wound remained open; limb shortened three and a half inches, but femur firmly united. There is also another opening in front of the thigh, about two and a half inches above the patella, towards the outer aspect of the limb, from which a long sinus leads upwards, apparently to the seat of the dead bone felt from the opening of entrance. The man will have a most serviceable limb when fitted with a high-heeled boot.

Extracts from the Monthly Reports from Chatham during the year 1859, *furnished by J. R. Taylor, Esq., C.B., F.R.C.S., Inspector-General of Hospitals, Honorary Surgeon to Her Majesty.*

"The invalided wounded during the mutiny commenced to arrive at the Invalid Depôt in April 1858, and during the fifteen months since elapsed the arrivals of this class of invalids have averaged 50 per month. The total, inclusive of the 54 arrived

during the month under report, is now 743, of which number 178 are cases of amputation or excision.

The total above referred to includes only Cavalry and Infantry of the Line; but thirteen of the Royal Engineer Corps, wounded during the mutiny in India, have also arrived at Chatham, and have been disposed of at the head-quarters of their corps at this station. A nominal and descriptive roll of eight of these thirteen cases was appended to the monthly report for January last, and a similar roll of the five arrived since is appended to this (*vide* p. 315). The total thirteen cases includes only two amputation cases, both being of the arm after gunshot wound.

During June, 1859, the addition of two cases of gunshot fracture of the femur to those previously arrived, led to the observation of the very large proportion of these cases to the total wounded, and on the striking difference in the proportion of these cases to thigh stump cases, as compared with the number and proportion of such cases furnished by similar returns of invalided wounded from the late war in the Crimea, contained in the Chatham Annual Medical Report for 1856-7. The number and proportion which these gunshot fractured femur cases bear to each other and to the total invalided wounded, seem to be of statistical value, as bearing on the question of the expediency, or otherwise, of amputation in that description of wound.

In the following tables these statistics are set forth, together with similar data collected from the records at Fort Pitt, of the invalided of preceding wars in India.

TABLE 1.—*Showing the number of invalids by all Wounds and of cases of Gunshot Compound Fracture of the Femur, and of Thigh Stump cases, passed through the Invalid Depôt, Chatham.*

	Total by all classes of wounds.	Total cases of Gunshot Compound Fracture of Femur.	Total Thigh Stump cases.	Remarks.
Sutlej—				[a] Exclusive of one dead of erysipelas when at Fort Pitt.
H.M.'s 29th only	47	2[a]	2[b]	[b] One of these recorded as lower third, in the other the third is not stated.
All Corps, H.M.'s Service	357	6[c]	18[d]	[c] Whether the fracture was completely through the shaft is doubtful in one of these cases.
Punjaub—				[d] One only specified as in upper and one in lower third.
All Corps, H.M.'s Service	129	...	6[e]	[e] The third specified only in one case, and that in the middle third.
Persia—				[f] In middle third.
All Corps, H.M.'s Service	4	1[f]	...	[g] Exclusive of one dead at Gravesend.
Mutiny of Bengal Army—				In the cases of recovery the trochanter is fractured in 2 cases.
All Corps of the Line, H.M.'s Service	743*	10[g]	13[h]	Upper third in 3 „ Upper as well as middle third in 1 „ Junction of upper and middle third in 1 „ Middle third in 1 „ Junction of middle and lower third in 1 „ Lower third in 1 „ Total 10
Royal Engineer Corps	13*	1	...	[h] Exclusive of one dead at Gravesend.
Preceding Indian wars...	1246	18	37	[i] In upper third ... 3 „ In junction of upper and middle third... 4 „ In middle third ... 1 „ In junction of middle with lower third... 1 „
Crimea—				
Of Cavalry and Infantry of the Line...	2296	9[i]	62[j]	[j] In upper third ... 3 „ In junction of upper and middle third... 1 „ In middle third ...15 „ In lower third ... 3 „ In third not stated 40 „

* Probably a few more wounded may arrive from India, but not a sufficient number materially to disturb the relation of the above figures.

TABLE 2.—*Proportion of cases of Gunshot Compound Fracture of the Femur to Thigh Stump cases, and to all cases of Wounds and Injuries in action, passed through the Invalid Depôt at Chatham; also the proportion of Thigh Stump cases to total of all classes of wounded.*

	Gunshot Compound-fractured Femur cases to		Proportion of Thigh Stump cases to total cases of Wounds and Injuries in Action.
	Total cases of Wounds and Injuries in Action.	Thigh Stump cases.	
Sutlej Campaign, 1845-46—			
Her Majesty's 29th Regiment only	1 to 23½	2 to 2	1 to 23½
All Regiments, H.M.'s Service ...	1 to 59½	1 to 3	1 to 19$\frac{13}{16}$
Punjaub Campaign, 1848-49—			
All Regiments, H.M.'s Service ..	1 to 129	1 to 6	1 to 21¼
Persian Campaign, 1856-57—			
All Corps, H.M.'s Service	1 to 4	1 to none	none to 4
Mutiny, Bengal Native Army, 1857-58			
All Regiments, H.M.'s Service ...	1 to 74$\frac{3}{10}$	1 to 1$\frac{3}{10}$	1 to 57$\frac{2}{3}$
Royal Engineer Corps	1 to 13	1 to none	1 to 13
Preceding Indian Wars	1 to 69$\frac{1}{16}$	1 to 2$\frac{1}{16}$	5 to 33$\frac{25}{27}$
Crimea—			
Cavalry and Infantry of the Line	1 to 255$\frac{1}{3}$	1 to 6$\frac{2}{3}$	1 to 37$\frac{3}{512}$

The preceding tables show of the Indian wars, as compared with the Crimean war, that the thigh stump cases arrived home from India are a fraction more numerous than those from the Crimea, in proportion to the total arrived by all wounds; and that the recovered cases of gunshot fracture of the femur also arrived are, in proportion to the total wounded, four times more numerous from India than from the Crimea. In other words, the proportion of thigh stump cases being so nearly the same, the gunshot fracture of the femur cases from India over and above the proportion from the Crimea, may be received as representing the proportion of the cases of this description of wound lost there by amputation, or by less favorable circumstances of service. The difference, I believe, is to be explained by the better appliances and means attending field hospitals in India, and to the less frequent practice there of amputation in this description of wound. The difference is not to be explained

by difference of missiles, for in the Peninsular war, where no other than the sixteen to the pound bullet was used, the impressions of surgeons experienced in the surgery of that war was, that in only few exceptions should a gunshot fractured thigh not at once be amputated. This rule greatly influenced the practice of surgery in the Crimean war, and hence, in a considerable measure, I believe, the less favorable results thence than from the mutiny in India, when surgeons were not only deterred from amputation of the thigh by the Crimean experience of the fatality attending that operation, but were more inclined to attempt preservation of the limb by the better means at hand for the conveyance and treatment of such compound fractured thigh cases.

Further, it is to be observed, that only one fourth of the total thigh stump cases are to be considered as amputations after gunshot compound fracture of the femur; and this being the case, the number thus wounded in the Indian mutiny, who have recovered with the limb on, is eleven, whilst the number recovered after amputation for this description of wound, is only between four and five. The records of thigh stump cases amongst the wounded from the Crimea, passed through the Invalid Depot, Chatham, rarely give the nature of the injury for which the amputation was performed, and the part of the shaft through which the bone was sawed is only recorded in twenty-two of the sixty-two total cases.

I subjoin brief extracts of ten* of the cases of gunshot compound fracture of the femur, and of the thirteen thigh stump cases referred to in the preceding remarks."

Mr. Taylor then gives a Tabular Abstract of the ten cases of Gunshot Compound Fracture of the Femur, which have already been detailed in the previous pages.

* The eleventh case is that of Sapper Charles Bones, R.E.

"Abstract of thirteen Thigh Stump cases, referred to in the preceding remarks.

1. John Smith.—Amputation at junction of middle and lower thirds after shell wound. Site not specified.

2. Hugh Nelson.—Amputation at junction of middle and lower third after cannon shot smash of knee joint.

3. Edward Byrne.—Amputation centre middle third after musket ball wound of thigh.

4. John Kehoe.—Amputation at junction middle and lower thirds (the primary was in lower third, but a secondary removal of bone became necessary) after musket ball wound, but not stated where; probably was of thigh or knee joint.

5. John Nolan.—Amputation middle third after grape shot smash of knee.

6. Thomas Ryan. — Amputation middle third after grape shot wound of knee.

7. Bernard Allen.—Amputation upper third after rifle ball wound, but site not stated.

8. Thomas Dixon.—Amputation middle third after cannon shot wound of knee.

9. George Lear.—Amputation at middle third after fracture of femur by musket ball.

10. James Nolan.—Amputation middle third after fracture of femur by musket ball.

11. M. Gearen.—Amputation middle third after fracture femur by musket ball (he says struck calf of leg, and the operation performed one month afterwards).

12. G. Donovan.—Amputation middle third on account of musket ball wound knee joint, with fracture of internal condyle (femur or tibia?)

13. J. Donaldson.—Amputation middle third after cannon shot smash of knee (?) bones of leg (?)."

Also John Sole, 2nd Battalion Rifles, page 204, and J. Williams, 3rd Battalion Rifles, page 204, with amputation in middle third, but caused by what missile I am now unable to state.

Fracture of the Tibia only.

Gunshot fractures of the leg are frequently of such a severe character as to require immediate amputation generally in the *thigh*, especially if produced by round shot or shell. Those caused by musket ball seldom call for the removal of the limb. In the leg, all the detached fragments of broken bone being so near the surface, are easily removed, and irregular portions from both ends of the fractured bone are generally taken away by the saw, if necessary.

When one bone only is fractured, the sound one retains the other in its place, and makes the case much less serious. When the tibia is fractured high up, and the knee-joint has been injured, it will be a case for amputation, as it is only on very rare occasions that the limb can be saved. When the fracture takes place near the ankle, and a fissure extends into the joint, it is rarely that the patient recovers. This, however, took place in Patrick Burrowes, 5th Regiment, under partial fracture, p. 137.

Under this head eleven were admitted, of whom two were sent to modified duty, and eight invalided. Only one was produced by grape shot, and the remainder by musket ball; three were still unhealed. They were all very severe compound comminuted fractures of this bone, and, with the exception of one, all were followed by necrosis to a greater or less extent; three occurred in the upper third of the bone, and three in the lower, one of which was so close to the ankle-joint that partial anchylosis resulted. One man, of the Royal Artillery, died at Gravesend, but his name is not included in this return, although I take the opportunity of giving the details of the case.

The following is a case of extensive necrosis of the tibia:—64th Regiment.—Private Edwin Beardsall, wounded July 16th, 1857, at Cawnpore, by a grape shot on the right leg about three inches above the ankle-joint. There was only a slight wound of the skin, but there was a comminuted fracture of the tibia; since then several very large pieces of necrosed bone have come away. April, 1858.—There is now a large deep

hollow on the anterior and inner side of the tibia, with two sinuses leading inwards, but no bone could be detected in this direction. There is a third sinus on the inner side of the tibia, where bare bone can be felt. He cannot bear much weight upon the limb, and the ankle-joint is stiff for want of use. December 22nd.—Unfit for service. Invalided.

The next case is a fracture of tibia, followed by anchylosis of the ankle-joint. 60th Rifles (1st Battalion).—John Flynn, æt. 21, wounded at Delhi, June 19th, 1857, by a musket ball, which entered the inner side of the left tibia, two inches above the ankle-joint, and probably passed out at the external malleolus. Several pieces of bone came away from the entrance wound. July 20th.—Wound healed, skin adherent to tibia, ankle-joint partially anchylosed.

The following fatal case is an example of an extensive comminuted fracture which had united, but the bone became diseased:—Royal Artillery.—Gunner John Abberley. This man was admitted into hospital at Gravesend, being unable to proceed to Chatham with the remainder of the men. He was wounded by a musket ball at Lucknow, the ball striking the upper third of the bone, under the attachment of the ligamentum patellæ, and carrying away a large portion of the bone. When taken on board ship, the wound was said to be about the size of a five-shilling piece, with the bone exposed in the centre, but looking healthy. Gangrene made its appearance about three weeks after sailing. When disembarked, the whole of the soft parts of the anterior surface of the leg between the wounded part and the ankle was one large slough, coming away with the dressings. The whole bone was exposed, the soft part on each side sloughy, blackened, and that offensive smell peculiar to the disease was present. Was emaciated in the extreme, and only kept up by the administration of stimulants to the hour of his death, which took place July 3rd, 1858. *Post mortem.—Body.* Much emaciated. *Thorax.* Old pleuritic adhesions between costal pleura and left lung; both lungs healthy and crepitant; heart and pericardium healthy. *Abdomen.* Liver healthy; stomach and intestines healthy, as also the remaining viscera. No. 3628. Right tibia, showing a compound comminuted fracture at its upper third, two inches below the

tubercle; the fractured ends have become reunited by very abundant depositions of new bone, especially on the posterior surface. In front there is a deep carious cavity, about two inches in diameter, and the same extent in depth. There is one large splinter on the inner side, which has become perfectly united to both ends of the tibia. In the recent state the whole of the anterior surface of the tibia was exposed, and in most part denuded of periosteum.

No. 2947, Plate VII, fig. 4, is an example of a gunshot fracture of the head of the tibia by a musket ball, making its exit on the inner side of the leg, fracturing and comminuting the bone, but not injuring the joint. The fractured portions have reunited, there is a very abundant deposition of new bone around them, and there is a large cavity in the centre, which is in an ulcerated state. Taken from Private Henry Farrer, æt. 32, 34th Regiment, an Englishman, by trade a moulder. Total service, fourteen and a half years, chiefly at home, and in the Mediterranean. Always enjoyed good health, and when admitted was a strong-looking man. He was wounded on June 7, 1858, by a musket ball striking the head of the left tibia, making its exit on the inner side of the leg, fracturing and comminuting the bone, but not injuring the joint. Since then he has always been in hospital. Considerable quantities of bone have come away, but without any severe pain or loss of health. On admission three openings existed, through each of which part a large sequestrum could be felt with a probe. December 13, 1858.—Died, nearly six months after the receipt of the wound, from pyemia.—*Post-mortem Examination.—Abdomen.* A portion of the convex surface of the liver adhered very firmly to the diaphragm by recently effused lymph. Corresponding to this portion, on making a section of the liver, a large diffused abscess was found, which contained ten ounces of pus, which was infiltrated throughout this part of the structure of the liver, several bands of which stretched across the sac. There was no defined wall to the abscess, which appeared to have resulted from the coalescing of several minute abscesses. The sac, on being opened, allowed a large quantity of very fetid gas to escape (sulphuretted hydrogen). There was a second abscess situated to the right of the other, and of nearly the same size. The rest of the structure of

the liver was soft and friable, and easily broken up. Weight of liver, 5 lbs. 3 oz. After a minute and careful examination, and tracing the veins of the left leg through the abdomen, no sign of inflammation could be detected.

It is, nevertheless, the opinion of some pathologists, that in the great majority of cases some trace of inflammation in the veins may be found, and when they cannot, the veins affected are supposed to be so small or so obscure that they are overlooked. Further, that pus globules have been detected in the blood of the pyemic, and even in the blood of animals which have died from the effects of pus injected into the veins. The globules of pus have only once been discovered, so that pus globules seem in a great majority of cases to be rapidly destroyed after entering the circulation. This throws considerable doubt on the view that the pus globules become arrested in the capillaries in consequence of their size, and thus establish numerous foci of inflammation. Rokitansky also expresses his opinion very strongly against it. He considers that pyemia occurs not uncommonly as a primitive affection, that is to say, that pus is actually formed in the blood itself in consequence of certain changes of a chemico-vital nature. This is well seen in *globular vegetations* in the *heart*. This supposition accounts for cases occasionally occurring in which there are multiple abscesses, yet no source of purulent infection can be discovered.—*Donor*, Dr. Williamson.

No. 2946 shows the tibia much enlarged, and presenting a cavity in its substance, from which a sequestrum has been detached, with several cloacæ. From a case of gunshot injury.

The preparation No. 2949 shows a gunshot fracture of the upper third of the tibia. The bone was comminuted, and the fracture united, but with some displacement. A portion of the crest of the bone appears to have been on the point of being necrosed. The external margin of the centre of the fibula is carious.

Fracture of the Fibula only.

Four fractures of the fibula were admitted, of which three have been sent to duty, and one invalided. One only was caused by grape shot, and three by musket ball. All were healed on arrival.

Fracture of the Tibia and Fibula.

Two have been admitted and been invalided. One was by a musket ball, followed by a sloughing and necrosis. The other was by a grape shot at the lower third of the leg, followed by anchylosis of the ankle-joint.

75th Regiment.—Private Thomas Dabney, aged 38, wounded at Delhi, June 8th, 1857, by a grape shot, which struck him on the inner and posterior aspect of the tibia, one inch above the right ankle, and passed out through the external malleolus. Several pieces of bone have come away. July 20th.—Wound healed. Skin adherent to bone, and parts much thickened. Ankle-joint anchylosed. Considerable loss of bone of both tibia and fibula. November 11th, 1858.—Invalided.

Preparation No. 2950 is a good example of fracture of both tibia and fibula at the upper third from gunshot. The fractured ends are united by a very abundant deposition of osseous matter, more particularly the tibia, in which there are several cloacæ leading into a cavity in the centre of the bone, where there were some portions necrosed. The fibula has been fractured obliquely; the superior portion lies to the outer side, and overlaps the lower to the extent of an inch, and the latter is united to the tibia by a quantity of new bone. New osseous matter is also deposited to a considerable extent on the surface of the tibia and fibula. On the anterior surface of the tibia, immediately above the fracture, absorption of the new bony matter seems to have been going on.

Necrosis of portions of the shaft of the tibia frequently follows gunshot wounds of the leg—more rarely of the whole thickness or length of the bone—leaving sinuses discharging pus for months or years, and rendering the patient liable to death from pyemia, as in the case of No. 2947, Private Farrer, page 161.

No. 2946.—Tibia much thickened, and presenting a cavity in its surface, from which a sequestrum has been detached with several cloacæ. From a gunshot injury.

The case of Beardsall is also a good example of loss of a great portion of this bone (tibia) by necrosis, page 160.

Penetrating, Perforating, or Lacerating the several Structures of the Tarsus and Metatarsus.

Gunshot wounds of tarsus and metatarsus give rise to caries in different bones, which generally results in contraction of the tendons and muscles of the feet; in the same manner as occurs in the carpus and metacarpus, and require the same mode of treatment.

18 were admitted under this head, of whom 6 were sent to duty, 4 to modified duty, 8 invalided. 11 were produced by musket ball, and 1 by round shot; only one remained unhealed. Two went through the calcaneum; one across the fleshy part of the sole of the foot; two through the tarsus only. The one by round shot bruised the bones, but did not break the skin, and caused severe injuries to both the tarsus and metatarsus. In those cases that were invalided the bones had been fractured, and tendons and ligaments lacerated, so as to produce in some cases considerable contraction and loss of power in the foot.

The following is an example of this injury:—24th Regiment.—Private Wm. Alexander, æt. 21, wounded at Jehlum, July 7th, 1857, by a musket ball, which struck the outer side of the right calcaneum, passed through this bone, and made its exit on the inner side. On September 26th, 1857, an incision was made on the posterior part of the os calcis, and necrosed portions of bone were removed, saving the attachment of the tendo-Achillis. August 2nd, 1858.—Wounds healed, but cannot bear his weight on the heel. 3rd.—Invalided.

CHAPTER XIII.

GUNSHOT WOUNDS, WITH DIRECT PENETRATION OR PERFORATION OF THE LARGER JOINTS, WITH FRACTURE OF BONE.

The following remarks are restricted to those cases where there is undoubted evidence of the joint having been penetrated. For instance, cases of partial or even complete fracture of bone close to a joint should be returned as a fracture of a long bone, and not as penetrating a joint. These cases, although generally very severe, and followed by acute inflammation and suppuration, ending in anchylosis (as in the case of Farraher, page 171), are not of such a dangerous nature as when the ball has passed directly through the joint, fracturing the bones, as in those included under the present head.

No description of wounds are more dangerous, and so frequently prove fatal, as gunshot wounds of joints; the result of these cases depends, in a great measure, on the size of the articulation, and the nature of the wound, the appliances that are at hand for treatment, the means of transport and provisions. The superiority of the two latter has been well illustrated in the success obtained amongst the wounded during the late mutiny in India, compared to what occurred during the war in the Crimea.

Wounds of ginglymoid joint are more severe than those of the ball and socket, partly from being of a more complex nature. Fissures extending into joints, although not always attended with serious consequences, still they are generally to be looked upon as a very severe injury. Much attention is also necessary in cases of gunshot wounds in the vicinity of the joint, on account of the inflammation that is so liable to be set up in them, and from the stiffness and contraction of the structures around from

want of use, and consequent pain on attempting motion in the joint.

It is of great importance to decide, as soon as possible, whether a joint is wounded or not; still no measures, by means of probing, &c., should be taken to ascertain this, as it would be almost certain to bring on severe inflammation. Should the wound have penetrated the joint, this will, in general, be soon made evident, by the symptoms which ensues; in cases of wounds near joints motion should be as early as possible had recourse to, to prevent contraction and partial anchylosis.

When a joint is actually wounded, inflammatory symptoms are almost always very severe, and set in shortly after the injury. The joint swells to a great extent, and the pain is very severe. Synovia, at first by itself, may flow from the aperture, and afterwards mixed with pus. There is great constitutional disturbance, and death frequently takes place from irritative fever or "pyemia." Should the patient survive the acute stage, abscesses form in the muscles around and about the joint, and this, with the profuse discharge from the articulation, generally causes death from hectic fever. Should the patient have the great and unusual good fortune to escape all these perils, and to have saved his life and limb, the joint will be anchylosed, and then he may consider himself exceedingly fortunate.

The admission of air into the joint is the cause of the suppuration, which also causes the pus to become acrid and putrescent. In cases of fractures and dislocation of joint, suppuration seldom takes place where there is no external wound.

The synovial membrane is the part first affected, the cartilage becoming secondarily diseased in gunshot wounds of the joints, or in what is called traumatic arteritis; whereas, in scrofulous affections of joints, the disease most frequently commences in the bone or cartilage. In recent cases of gunshot or bayonet wounds of joints, the synovial membrane becomes swollen, gelatinous, and of a red colour, and the cartilage beneath becomes softened and partially absorbed; when suppuration has taken place for some months, the cartilages are eroded at parts, exposing the bones underneath, which are carious,

and what remains of the cartilage at any particular part is swollen, pulpy, and vascular.

Admitted from India:—Wounds of larger joints, with fracture of bones, 10; ditto without fracture, 1. Total, 11. Of these, 9 were invalided, and 2 discharged to duty. 1 occurred in the shoulder-joint, 4 in the elbow, 1 in the carpus, 2 in the knee, and 1 in the ankle. 8 were caused by musket ball, and 1 by a pistol bullet. Except 2, all were healed.

In addition to these wounds of the larger joints, there were 3 cases of excision, viz.:—2 of the elbow and 1 of the shoulder-joint, which will be detailed under that head.

In the Crimean war 121 cases occurred amongst the men, of whom 25 died without any operative interference, and 10 among the officers, of which 4 were treated without operation; and of this number, 3 terminated unfavorably.*

Shoulder-joint.

Only one case is returned under this head as having arrived from India, and the history of the case is detailed under the class Resections, this operation having been performed at Fort Pitt. In several cases inflammation had taken place contiguous to the joint, resulting in thickening and contraction of the muscular and ligamentous structures, and in some cases the joint had become completely anchylosed, as in Private J. Day, 32nd Regiment, under the head of Amputation of the Arm.

The preparations Nos. 2921 and 2922 show the starred fracture and fissures resulting from gunshot injury of the head of the humerus.

"Of 17 gunshot injuries of the shoulder-joint amongst the Crimean wounded, 2 were fatal in the primary hospitals without operation, the cases having apparently been complicated with some injury to the contents of the chest. One patient died in the secondary hospital at Balaklava, of idiopathic fever, contracted while under treatment for the wound, while the whole number of the remaining cases, viz., 14, required operative interference."

* *Vide* 'Report on the Crimean Wounded,' vol. ii, p. 350.

Elbow-joint.

Four cases were admitted from India. All have been invalided.

In these elbow-joint cases there can be no doubt of the direct penetration of the joint, with comminution of bone, resulting in anchylosis. In three of them the ulnar nerve was injured. In these instances the olecranon was fractured, and in one case the external condyle; the joint was anchylosed in all of them. In three of them the forearm was at an obtuse angle. In the fourth case the arm was quite straight, and the elbow-joint anchylosed, rendering the arm very useless; but in this case the humerus had also been fractured, making it very difficult to treat; even now the limb is much more useful than any artificial arm which he could have been supplied with.

In none of them had resection been performed, and it becomes a question whether these patients would have had a more useful arm had the joint been excised, so as to allow of free motion of the joint. If it were possible to induce patients to use the arm at an earlier period of the treatment, they might preserve some motion in the joint.

"Of 30 injuries in the elbow-joint among the men in the Crimean War, and 4 among the officers, 4 were fatal without operation. 2 of these were complicated, with injury of the artery (1 of the brachial and 1 of the ulnar), and the fatal result seems to have been mainly due to the continued effects of shock and loss of blood."

In the two following cases from India the joint is anchylosed, and the arm in a bent position. 32nd Regiment.—Private Harry Arthurs, æt. 33, wounded September 27th, 1857, at Lucknow, in the left elbow. The musket ball entered over the external condyle, and passed out on the inner side of the olecranon opening into the joint; severe inflammation and suppuration followed. The arm is now in a bent position, and the elbow-joint is anchylosed. He has lost the power over the fingers, and has no feeling in half of the ring finger and little finger. June 22nd, 1858.—Invalided.

78th Regiment.—Private William Wardleworth, æt. 34, wounded at Lucknow, September 25th, 1858, by a musket ball in the right elbow-joint. It entered over the olecranon, and was

cut out at the same place the following day; abscesses formed around the joint. 2nd. By a musket ball on the inner side of the left-knee; a flesh wound. July 13th.—The wounds are all healed, and the elbow-joint anchylosed. There is one large cicatrix on the inner side, adherent. August 5, 1858.—Invalided.

In the next case the joint was anchylosed, and there was also an injury of the ulnar nerve. 52nd Regiment.—Private James Marshall, æt. 27, wounded at Delhi, September 14, 1857, by a pistol ball, which passed through the elbow-joint. It entered close to the outer side of the olecranon process, and between it and the external condyle, and passed through the olecranon, and made its exit on the inner side of this process, close to the ulnar nerve. There was a discharge of synovia from the wound for some days. July 20th.—Wound healed; elbow-joint bent and anchylosed. Has lost the sensation of the little and one half of ring fingers. July 22nd, 1858.—Invalided.

The following is a case of wound of the joint, complicated with fracture of the shaft of the humerus. Elbow-joint anchylosed, and the arm in a straight position. 61st Regiment.—Private M. Dunne, aged 38, wounded at Delhi, July 9th, 1857, by a musket ball, which entered through the centre of the right deltoid muscle, and passed downwards, fracturing the humerus about its centre, and made its exit at the elbow-joint, where it also appears to have wounded the joint and fractured the olecranon process of the ulna. The arm was placed upon a straight splint. Both apertures of entrance and exit soon healed, but considerable inflammation of the arm and elbow-joint ensued, which was relieved by free incisions. September 5th, 1858.—Wounds made by musket ball healed. There are two sinuses on the outer aspect of the arm, about its centre, leading down to necrosed bone. The fracture at this point is united; the forearm is in a straight position, and the elbow-joint anchylosed. The arm is about one and a half inches shorter than the other. January 13th, 1859.—Invalided.

Hip-joint.

No case of wound of this joint arrived from India. There is a preparation in the Museum, No. 2930, where the old ball

is firmly lodged in the head of the femur, having produced only a fissure. This would have been a favorable case for resection. The following is a description of it:—No. 2930 (see Plate VIII, fig. 3).—A matchlock ball, firmly lodged in the head of the femur. The ball entered opposite to the trochanter major, and passed through the brim of the acetabulum. From Private Alexander M'Phail, æt. 32, wounded at Dubha, March 24, 1843, by a matchlock ball, which entered a little above the great trochanter of the right limb anteriorly, and was lost. The leg became powerless. On coming to Colaba, on April 28, he did not complain of much pain, except when the joint was moved. Slight fulness over the hip was the only symptom of injury. Leeches and counter-irritation were employed, and he seemed to get better. On May 6th he was attacked with trismus, and died on the 9th. The ball was found imbedded in the head of the femur, which, with half of the brim of the acetabulum, was shattered, and the capsular ligament formed the sac of an abscess, which contained a considerable quantity of pus and spiculæ of bone. The orifice of the wound, it is added, had closed some time previous to his death.

Knee-joint.

Two were admitted from India. One was invalided, and the other remains.

In one case the synovial membrane was directly perforated, but no fracture of bone had taken place. In the other it is doubtful if the ball penetrated the cavity of the joint, although the surgeon says it passed through the joint.

In the Crimean war, 23 cases are returned among the men, and six in officers. Six of these patients died, viz., three men and three officers. Thirteen men and two officers were discharged for operation, but only one of those for resection of the joint, and in that case the operation was a secondary one, an attempt having been made in the first instance to save the limb. In the remainder amputation was resorted to.

In the following case from India the ball seems to have passed through the condyles of the femur, and was followed by partial anchylosis. Private John Dunlay, aged 26, wounded at

Lucknow, November 16th, 1857, by a musket ball, which struck him on the inner side of the right knee, two inches from the side of the patella, passed through the condyle of the femur and knee-joint, and passed out on the outside of the joint, close to the head of the fibula. July 13th.—Wounds healed, knee-joint slightly bent, and partially anchylosed. Can walk tolerably well, and has a very useful limb; neither cicatrix adherent to the bone.

In the next case it is rather doubtful whether there was direct penetration of the joint. 93rd Regiment.—Serjeant David Simm, wounded at Royah, on April 15th, 1858, by a bullet which entered one and a half inches to the inner side of the patella, over the inner condyle of the femur, and made its exit at a little higher level, over the tendon of the inner hamstring. It is doubtful if it entered the cavity of the joint, although the surgeon says, "passed through the joint." It was followed by acute inflammation of the joint, and the limb cannot now be fully straightened, and on flexing it a grating sensation is felt.

The following case, although not included in the Return as a wound of the joint, is interesting as showing the inflammation extending to the structures of the joint, terminating in anchylosis. 61st Regiment.—Private Martin Farraher, wounded August 25th, 1857, by a musket ball, which entered the external condyle of the left knee-joint, making its exit through the outer side of the popliteal space. Considerable inflammation and swelling of the joint ensued. September 5th.—The joint itself does not appear to have been wounded, but from its proximity, severe inflammation followed, resulting in complete anchylosis. There are livid spots on his leg, from his constitution being tainted with scurvy, and his gums are spongy.

The following preparation, No. 2933 (see Pl. VIII, fig. 4), shows the condyles of the femur and the patella fractured by a carbine ball, which in its entrance has comminuted the point of the patella, split the bone longitudinally, and lodged in the bone between the condyles, and caused a fissure through the internal one. From Private M. Walsh, 3rd Light Dragoons. The injury took place while the leg was in a state of flexion, from the accidental discharge of his comrade's carbine. The limb was amputated twenty-four hours after, and the man arrived at Fort Pitt quite well at the end of three months.

The two following preparations, Nos. 2943 and 2944, are very interesting, as showing a perforating gunshot wound through the knee-joint. The ball entered the back part of the joint, and passed directly forwards, and shattered the patella in its exit, followed by recovery and anchylosis. Twenty-six months after the injury the man died at Fort Pitt, of an enormous abscess of the liver, the result of previous service in India. No. 2943. Section of a knee-joint, the bones of which are completely anchylosed, and the capsule obliterated. Dense cellular tissue occupies the interspaces of the articular surfaces. No. 2944 (see Pl. IX, fig. 1). Section of the preceding knee-joint, in which the soft parts have been removed, showing the cancelli of the femur and tibia, and also of the patella, completely continuous. The patella was irregularly fractured, and the fragments are now consolidated by osseous matter, and united to the femur. From Private Edward Marr, aged 35. 20th Regiment.—Was sent home from India in consequence of a gunshot wound of the left knee-joint, received on October 21st, 1833. Admitted into Fort Pitt, 10th May, 1835. Left knee-joint was anchylosed; there was a cicatrix between the vastus externus and triceps, and another immediately above the superior border of the patella. Muscles of the limb much attenuated. General health very indifferent, being under treatment for disease of the liver, of which he died on May 20th, 1835. On post-mortem examination there was found a large abscess in the right lobe of the liver, which communicated through the diaphragm with the base of the right lung. The sac of the abscess contained six pints of thick pus. The spleen was very much enlarged and softened. The peritoneal cavity contained two pints of turbid serum, with flakes of lymph floating in it.

The following preparation of a severe comminuted fracture of the head of the tibia is interesting as showing the discovery of a second fracture of the tibia, not compound, however, and situated about the middle of the bone. The skin over it showed not the least trace of injury from the fracture. How the fracture was produced is a matter for conjecture. If excision of the joint had been contemplated, this after discovery would have been, at the least, embarrassing. No. 2948.—Compound comminuted fracture of the head of the left tibia, caused by a shell.

Fig 3.

408

Fig 2

2916

Fig 1

2944

Fig 3a Aperture between femoral artery & vein
b Coagula in femoral artery & vein.

C.H Ford.

There is a second fracture situated about the middle of the bone. From Private James Aitkin, æt. 27, who received a severe shell wound of the left leg in the trenches on August 18th, 1855. He was standing erect at the time. The knee-joint was distinctly opened into, and the head of the tibia severely comminuted. Amputation was immediately performed, and the patient recovered.—*Donor*, Dr. Cowan, Assistant-Surgeon, 55th Regiment.

The following preparation shows a bayonet wound of the knee-joint, followed by severe inflammation, profuse purulent discharge, and irritative fever, rendering amputation necessary sixty days after the injury. No. 3633.—A portion of quill passed through the original wound shows the direction it took; it is situated just beneath the level of the patella, and a little to the right side. The synovial membrane is thick and gelatinous. West York Rifle Regiment.—Private John Gannell, of strong, healthy aspect, while drinking in a public-house, on February 5th, 1858, a sergeant of another regiment drew his bayonet and wounded him on the left knee. The wound had every appearance of having penetrated the joint; the pus was excessive; the wound, though small, was deep, and situated just beneath the level of the patella, and a little to the right side of it. Late in the evening of the 5th he was delirious, and in great agony; his sufferings were so great that anodynes had to be largely given before anything like a quiet state could be arrived at; the knee became swollen, and the pain continued, and showed signs of the formation of pus in the joint; abscesses also formed outside the joint, and were opened. A profuse discharge of purulent matter continued from the wound, and the man's appearance, pulse, &c., assumed the hectic character rendering amputation of the limb necessary, which was performed April 6th, and the patient recovered.—*Donor*, Assistant-Surgeon Taylor, Royal Artillery.

14th Light Dragoons.—Private James Ball, æt. 30, was wounded at Muddenpore Pass on 3rd March, 1858, by a musket ball, which entered the outer side of left knee, and was cut out about two inches posteriorly. Joint primarily injured? The surgeon says, No; but the contrary seems probable. Free incisions around the joint were subsequently required. The limb can now only be flexed to a slight extent, but the joint has

lateral motion in a direction inwards to middle line. Invalided June 29th, 1859.

Sergeant Michael Kearnan, 88th Regiment, was wounded on the 21st of October, 1858, at Burwah, by a musket ball, which entered over the outer hamstring. The wound is now soundly healed. The limb is somewhat atrophied, apparently from disease, but the motions of the joint are perfect. It is just possible that the cavity of the joint was not opened; but from the position of the cicatrices of entrance and of exit, it seems difficult to conceive how this could have been the case; and as usually happens when an instance of wound or injury of more than common interests presents itself, the documents forwarded with it are almost entirely destitute of information. If the joint was opened, the result of the case may be looked upon as most successful, for, as before stated, the motions of the joints are uninjured, and the limb will almost certainly recover its strength under judicious exercise.

Ankle-joint.

The following case was the only admission from India under this head:—37th Regiment.—Private Charles Smith, wounded April 17th, 1858, near Azinghar, by a musket ball, which entered the left instep in front, and about the internal malleolus, and was cut out about two and a half inches lower down, and a little posteriorly. The inner malleolus appears to have been removed subsequently in fragments; anchylosis of the ankle-joint has followed; the foot turns slightly inwards, and the great toe is stiff. Invalided February 9th, 1859.

G. Duddley, æt. 28, 53rd Regiment.—Was wounded in Oude on the 27th April, 1859. The wound was in the right ankle-joint; for the most part only a contusion of the skin, but there was a small irregular opening through which apparently a jagged piece of metal had passed, and from which synovial fluid exuded in considerable quantities. Great swelling of the foot set in, but this subsided, and the wound healed. The ankle-joint still remained slightly stiff, but otherwise walked well, and was sent to duty.

CHAPTER XIV.

GUNSHOT INJURY OF THE LARGER ARTERIES, NOT BEING AT THE SAME TIME CASES OF COMPOUND FRACTURE.

UNDER this head one was admitted and invalided from India. It is, however, probable that the case of Private Bulger, which is detailed at page 134, is of this nature.

It is seldom that primary hæmorrhage occurs on the field of battle, even though the ball may have passed directly through the course of a large artery. This is in some measure accounted for, although not entirely, by the round form and the strong elastic coats, but especially by the mobility of the vessel.

Arteries and veins firmly bound to bone are more likely to be injured than those that are lying loose in the fleshy parts of a limb; for instance, the femoral on the brim of the pelvis.

The coats of the veins, being thinner than the artery, are much more readily injured, and primary hæmorrhage proceeds more frequently from them than from the arteries.

Only 14 such are returned amongst the men during the whole period of the Crimean war, and one in an officer.

The following preparation is a beautiful example of the elasticity and toughness of the coats of both artery and vein, and likewise of the mobility of these vessels, allowing of being pushed aside by the ball.

No. 408 (see Plate IX, fig. 3). Portion of the femoral artery and vein, between which a ball has passed, causing mortification of the limb, and death.—*Donor,* J. Guthrie, Esq., D.I.G. This specimen was taken from Private P. Tumbrill, of the Grenadiers of the 74th Regiment, of good stature, who was wounded on April 10th, 1814, by a musket ball, passing from the inside to the outside of the middle of the thigh; he says it bled considerably at

first, but the bleeding soon ceased; the wound was not painful, and he thinks he observed the leg and foot to be colder than the rest of his body for the first two or three days, but did not much attend to it, further than conceiving the numbness, coldness, and impeded power of motion as natural to the wound.

"On the 18th April the gentleman in charge of this patient pointed him out to me as an extraordinary case of gangrene, coming on without, as he supposed, any sufficient cause. The wound on the outside of the thigh, or the exit of the ball, was nearly healed, and that on the inside was without inflammation or tumefaction, and with merely a little hardness to be felt on pressing. The pulsation of the artery could be distinctly felt to the edge of the wound; the leg was warm; the gangrene confined to the toes; the artery of the other thigh could be distinctly traced down to the tendon of the triceps. As he was at a small hospital about two miles from town, I did not see him again until the 20th, and afterwards on the 23rd, when, although the gangrenous portion included all the toes, it had the appearance of having ceased. Satisfied that it would again extend, I left directions with the assistant-surgeon that the limb should be amputated below the knee.

"The surgeon, whom I had not seen, and who did not understand the subject, disobeyed the order, conceiving there must be some mistake. On visiting the hospital a little after daylight on the 25th, I was greatly annoyed at finding the operation had not been done, and that the mortification had begun to spread the evening before. It was then too late; on the 26th it was above the ankle, with considerable swelling up to the knee; at night the man died, and the next morning, at six o'clock, I removed the femoral artery from Poupart's ligament to its passage through the triceps, which part was affected by the mortification.

"The ball had passed between the artery and vein in the spot where the vein is situated nearly behind, and adherent only by cellular membrane, through which the ball made its passage; the coats of the vein being little injured, and those of the artery not destroyed in substance, although bruised; it was at this spot much contracted in size, and filled above and below by coagula, which prevented the transmission of blood, and the vein above

and below the wound was filled with coagulum, and was also impassable."

This preparation is unique. It is perhaps the only one in existence proving the elasticity which vessels possess, and their capability of avoiding to a certain extent an injury about to be inflicted on them.

Ligature of Arteries.

Three cases requiring ligature of arteries occurred: one was deligation of the radial artery, eleven days after a gunshot fracture of the ulna, implicating this artery; another was for secondary hæmorrhage, one month after a gunshot wound of the leg, with partial fracture of the tibia; the ligature was placed upon the lower third of the posterior tibial. In the third case the femoral artery was tied.

53rd Regiment.—Private Patrick Hanafin, wounded at Lucknow, November 16th, 1857, by a musket ball, which entered on the inner side of the left tibia, about three inches above the ankle-joint, and passed through the fibula, three inches from its lower extremity; about one month after, secondary hæmorrhage took place, following sloughing of the wound, requiring ligature of the posterior tibial at the lower third of the leg. He was also wounded in the right thigh by a musket ball, which entered on the outside near its centre, and passed through in front of the femur, on the inner side, close to the course of the femoral artery. Both wounds are healed.

Private John Skinner, 6th D. G., æt. 24.—Was wounded 24th November, 1858, at Dundekereraih, by a musket ball, which passed through the left popliteal space, apparently injuring the tendons of both hamstring and wounding the artery. The femoral artery was tied at scarpa's triangle on the same day, apparently on account of hæmorrhage. Knee now contracted nearly to a right angle, and any attempt to straighten it gave great pain, extending down the leg to the foot. The foot is cold and numb, and the whole limb is wasted. Invalided on account of impaired use of left leg by result of perforating gunshot wound of ham, with direct injury of the popliteal artery.

CHAPTER XVIII.

AMPUTATIONS.

In gunshot wounds the surgeon must be cautious not to condemn a limb too hastily, as it will present quite a different appearance when the splintered pieces of bone, the coagulated blood, and dirt have been removed.

There can be no doubt that amputation is necessary when a limb is carried off and a rugged stump only left; when it is completely disorganized by round shot, though still left adherent; when a large extent of soft parts are carried away along with the principal vessels, even although the bone remains uninjured; and also in the greater number of cases of compound comminuted fractures of the femur.

Besides the cases on which there can be no doubt of the propriety of the instant removal of the limb, there are others of doubtful character; still it is advocated by some surgeons that this would diminish the amount of mortality, if immediate amputation was performed on these also, although it cannot be denied that in some of these doubtful cases a very useful limb might be saved. These cases will be more fully explained afterwards.

Military surgeons have divided amputation into *primary* and *secondary:* the *primary* are those that are performed within the *first twenty-four hours,* before inflammation has taken place in the injured parts; and *secondary amputation,* those that are performed after the inflammation has set in. Some surgeons have a third division, or "intermediate amputations," which are those performed from the twenty-fourth hour until suppuration has taken place. This, however, is rather difficult to follow in practice, and it is not generally adopted. The mortality after primary amputations in civil practice is greater than after secondary operations; while in military practice the case is

different, secondary amputations being very much more fatal. The causes of this difference between the results of amputation in civil and military life are various.

The shock to the system is the chief cause of death after primary amputation, and this is much more severely felt by the civilian than the soldier. The civilian, on receiving an injury demanding amputation, is depressed with the extent of his misfortune, with, perhaps, the ruin of his family before him, whilst the soldier in action has his courage strung to the highest; in many cases to such an extent as not to be aware of the severe injury he has received, which renders his chances of recovery much greater than that of a patient in civil life.

The soldier has the advantage over the civilian as to his chance of recovery after a primary amputation, but the case is reversed as to secondary amputation. Should the limb not have been removed shortly after the injury, the soldier is placed in some crowded temporary hospital, or perhaps removed further to the rear, over rough roads, with the fractured ends of the bones producing serious mischief and a fearful amount of pain to the patient, while the civilian is at home stationary with every comfort.

The cause of death is also different in primary and secondary amputations.

In *primary amputations* death is usually caused by the shock or exhaustion.

In *secondary amputations*, pyæmia, pneumonia, congestion, diarrhœa, or some low form of visceral disease, are amongst the most frequent causes of the fatal termination. There is a greater liability to the occurrence of gangrene of the stump and pyæmic poisoning of the blood after amputation for gun-shot wounds, than where the limb has been removed for disease. In the latter the chief cause of death is from tubercular deposits in the lungs.

The question as to the period at which amputation ought to be performed is now happily considered settled. The experience of every war, and particularly by the labours of Larrey, Guthrie, and Hennen, the advantages of primary over secondary amputation has been fully established. Amongst the Russians during the late war it is stated that there were 3000 amputations,

and of the primary amputations of the upper extremity, leg, and foot, about one half recovered, and of the lower and middle third of the thigh, about two thirds died, but of all the secondary amputations more than two thirds died. Neither these figures, nor those of any other army, however, shows how many died before the secondary amputation was resorted to, which would still make it much more in favour of the primary operation. It is now, therefore, an established rule in military practice that immediate amputation should be performed.

The shock which generally follows severe injuries does not usually appear for some short time after the wound, leaving an interval which seems to depend partly upon the severity of the wound, and the constitution of the patient. Occasionally there are cases in which there is no shock. If this interval could be seized, and the operation performed under chloroform, the chances of success would be much greater. When the shock is very marked, and the patient greatly prostrated, delay may be necessary; but it is thought by some military surgeons that the presence of the shock does not militate against the operation when done under the influence of chloroform.

Chloroform is thought by some surgeons not to intensify the shock, but rather to give more stamina to the patient, so that its early use need not be dreaded, nor is it necessary to wait for its subsidence before operating.

According as the line of amputation approaches the trunk and the size of the part amputated, so does the danger of a fatal termination increase.

In the Crimea the per-centage of deaths after amputation was, of the hip 100 per cent., of the thigh 64, of the leg 37, of the foot 16, of the shoulder-joint 35, of the arm 19, of the fore-arm 7, which shows the increase of mortality the nearer to the body that the limb is removed, and also the greatly less likelihood of a fatal termination in amputations of the upper extremity compared to that in the lower.

It is well known that amputation of the thigh becomes more fatal in proportion as the limb is removed high up, so that recovery after amputation in the upper third for compound fracture of the thigh is a very rare occurrence.

The relative advantage of the circular over the flap operation

in military practice is still an unsettled question. The circular operation leaves a firm cushion, which bears hasty removal over rough or uneven roads, on being taken to the rear: whilst the large flaps become bruised and knocked about, and are apt to reopen and slough, or secondary hæmorrhage to take place: this is especially the case in the large muscular flaps of the thigh and leg, but in the upper extremity, this objection is not of so much importance. One of the arguments in former days in favour of the flap was, the rapidity with which it could be performed; this, however, is done away with since the introduction of chloroform. The other argument put forth by the advocates in favour of each particular method are not of so much importance.

Total number of amputations, 195. Of these, 8 were sent to duty; 29 to modified duty; 156 invalided; 2 died.

It may be mentioned that Mr. H. Bigg supplied the men with every mechanical appliance, on the most approved principle which his experience could suggest.

Amputation of the Superior Extremities.

The *scapula* and a portion of the *clavicle*, along with the *superior extremity*, have been removed by amputation, but generally after disarticulation has been performed at the shoulder-joint. In 1847 Professor Fergusson removed the scapula in the case of an old invalid soldier, on whom I had performed amputation at the shoulder-joint three years before, for caries. The patient ultimately recovered and got into excellent health.

However, for none of these operations can rules be laid down further than those of the common principles of surgery.

Amputation at the Shoulder-joint.

Amputation at the shoulder-joint is not a difficult surgical operation. There are about thirty different methods of performing it, and all require a thorough knowledge of anatomy; still there are only two methods which are now usually resorted to in the present day by those most competent to judge. The first is by superior

and *inferior*; and the *second* by *anterior* and *posterior flaps*; but either method may be modified by a skilful surgeon so as to suit any case. Both methods are, however, equally applicable in military practice, as immediate amputation is most generally required when the shaft or head of the bone has been fractured, and consequently no leverage can be obtained by the shaft of the bone. Therefore, in most cases of gunshot wounds of the head of the humerus, the incisions will be required to be made from *without inwards*, and not by *transfixion*.

The SUPERIOR and INFERIOR FLAPS are generally performed in the following manner, according as to which arm has to be amputated:—A strong straight bistoury, or small amputating knife, should be inserted in front of the acromion process (if on the left arm, and the reverse if on the right), and a semilunar incision made backwards to about the centre of the fleshy part of the shoulder; this flap is then dissected upwards, the joint entered and disarticulated, and an inferior flap formed. The most important part of the operation is that the assistant follows the knife (in making the last flap) with the palm of his hand, so as to grasp securely the brachial artery.

Anterior and posterior flaps may be made according to the state of the soft parts and condition of the head of the humerus; but in either method care must be taken to preserve enough of covering.

Anterior and Posterior Flaps.—When the left arm has to be amputated, the point of the knife should be placed in front of the posterior fold of the axilla, and carried upwards and forwards until its point appears just in front of the acromion; the knife should be then carried with a sawing motion downwards, backwards, and outwards, so as to make a flap four or five inches in length, formed chiefly of the posterior part of the deltoid. On the assistant having raised this flap, the articulation should be opened into by cutting the tendons which are inserted into the head of the humerus. By judicious movements of the arm the head of the bone is easily disarticulated (if there is no fracture of the neck of the bone), and the knife is then passed in front of the bone, and then carried downwards and forwards to form an anterior flap about the same length as the other. Immediately before cutting the axillary artery

the assistant should slowly and deliberately follow the back of the amputating knife, with the palm of his hand in the wound and the thumb outside, so as to grasp the whole of the flap, but especially the axillary artery. By following this plan, compression above the clavicle is quite unnecessary, provided you have an assistant that you can depend upon. The celebrated surgeon, Professor Fergusson, and who was also my respected teacher, states that I was the first to amputate at the shoulder-joint without compression of the subclavian.

Eight were admitted and invalided; only one remained unhealed. Four were by the superior and inferior flap, and four by the anterior and posterior flaps; the stumps were all good and round, and the integuments not puckered; both methods of operating gave equally good results: all were done under the influence of chloroform; all were primary operations.

In the following case the stump sloughed:—Rifles (2nd Battalion).—Private James Gayler, wounded at Cawnpore, November 28th, 1857, by a grape shot, which shattered the arm. Amputation was performed at the shoulder-joint, three hours after the injury, under the influence of chloroform, by anterior and posterior flaps; the ligature did not come away for some time, and caused considerable irritation; sloughing also took place, with much suppuration. July 11th, 1858.—The stump is good and solid, although there are three small portions of the margins of the flaps unhealed, with exuberant granulations arising from them. September 3rd.—Modified duty.*

The two following preparations are good examples of necrosis affecting the stump of the humerus, comprising nearly the entire thickness of the shaft, occurring in a very scrofulous subject, and which demanded secondary amputation at the shoulder-joint two years after the primary operation. Death from pyæmia ten days after the last operation. No. 2916 (see Pl. IX, fig. 2).—Section of the stump (in spirits) of the upper half of the humerus, removed by secondary amputation at the shoulder-joint. A portion of the upper part of the shaft of the bone,

* I am sorry that I am unable to insert the names of the medical officers who performed the various operations, in consequence of the documents sent home rarely stating by whom they were performed; but as far as it has been in my power I have done so; and also given the names of the donors of the preparations to the Museum at Netley.

immediately below the neck, about two and a half inches in length, and comprising nearly the entire thickness of the shaft of the humerus, is necrosed; the necrosed portion is firmly enclosed in a case of new bony deposit, through which there are two apertures opening externally; the medullary membrane is soft, spongy, and inflamed; the medullary canal is open inferiorily at the amputated extremity, and allowed of the free escape of discharge; a thick layer of new bone entirely surrounds the whole of the shaft. No. 2917.—Is a section (dry preparation) of the preceding. The entire shaft of the bone, with the exception of its neck, is surrounded by a thick, granular deposit of new bone. The compact structure of the old bone is soft and cellular; the medullary canal is also rough and spongy, the result of inflammation of its lining membrane; there is also an aperture in the neck of the bone, communicating with the medullary canal.—*Donor*, Dr. Dane, Staff-Surgeon. This specimen was taken from Private James Clarke, 77th Regiment, æt. 21, of highly strumous diathesis and unhealthy aspect. He had suffered amputation of the arm about the middle third, in May, 1854, in consequence of severe gunshot wound, and on admission into hospital at Colchester, September 4th, 1855, the wound was healed through the greater part of its extent, but there were two small sinuses opening on the face of the stump, which discharged profusely, and dead bone could be detected by a probe through each of them; his appetite was bad, and general health indifferent. April 19th, 1856.—His progress was so unsatisfactory that the operation of removing the stump at the shoulder-joint was decided upon, as the only chance of saving his life. He was low after the operation, but rallied, and seemed likely to do well, until the 23rd, when he became low, irritable, and unable to take nourishment; constant nausea and diarrhœa set in, and a train of inflammatory symptoms, under which he gradually sank, and died on May 1st. At the *post-mortem examination*, the liver was found large and friable; the right kidney diseased; serous effusion in the peritoneal cavity, and deposits, marking the existence of sub-acute peritonitis; and the intestines were soft, dark, and injected. The whole structures around the shoulder-joint were abnormal and degenerated; and the cla-

vicle, scapula, and first rib extensively affected with disease, similar to that exhibited in the preparation of the humerus. The cancellous structure appeared disorganized, dark, spongy, and soft, and filled with a dark-brown fluid (which was not found in the humerus when removed), in which it appears that the bony structure was gradually becoming, as it were, dissolved, but there was no attempt at formation of new bone around, as in the arm.

The two succeeding preparations from two soldiers of the same regiment, who received compound comminuted fracture of both bones of the forearm, at Inkerman, November 5th, 1854. Amputation at the centre of the arm was immediately performed. Necrosis followed in both cases, and amputation at the shoulder-joint was performed on both patients, July 25th, 1855, eight months after the primary operations.

The necrosis in the preceding preparation, No. 2916, and the two under notice, appear to have originated in inflammation of the medullary membrane and canal.

No. 2918. The necrosed portion comprises the entire thickness of the end of the shaft, and is about five inches in length, nearly detached, and partly surrounded by a new osseous case. From Private James Leman.—*Donor*, Dr. Browne, Assistant-Surgeon, Coldstream Guards.

No. 2919. The necrosed portion comprises the entire thickness of the shaft, and is about two inches in length, and is not situated at the end of the stump, but at the upper part of the shaft, close to the tubercle, and is partly surrounded by new osseous matter. From James Curds.—*Donor*, Dr. Munro, Surgeon-Major, Coldstream Guards.

Amputation of the Arm

Close to the tuberosities is similar to that recommended for amputation at the shoulder-joint, viz., by superior and inferior flaps, and cutting from without inwards (not transfixing).

Amputation in the Middle of the Arm, or immediately above the elbow-joint, may be done either by the flap or circular methods. In describing the different amputations I shall not enter into minute details, which every surgeon knows.

Fifty-two cases were admitted, of which 3 were sent to modified duty; 48 invalided; 1 died. Of these, 33 were in the middle of the arm, and 12 in the upper third; 1 quite close to the tubercle; 41 were healed, and 5 still remained open; in 37 instances the cicatrix did not adhere to the bone; and in 9 cases it was found to adhere to a greater or less extent, generally very slightly. In 36 instances the flap operation appears to have been performed, and the circular method 8 times. 30 operations were done under the influence of chloroform, and 14 cases without this agent. 35 were primary, and 11 secondary amputation. In 3 cases severe sloughing of the stump followed. 2 of them ultimately recovered; the third died at Fort Pitt. In 1 case there was also anchylosis of the shoulder-joint, resulting from the injury caused by round shot.

The following is an example of sloughing taking place in the stump, along with hæmorrhage from some small vessel, occurring in a scrofulous subject after a second amputation in the arm. It also shows how difficult it would have been to have found and secured the bleeding vessel in this case. 32nd Regiment.—John Healy, æt. 20, wounded at Lucknow, September 5th, 1857, by a round shot on the right wrist, carrying away the hand. The forearm was amputated the same day by double flaps under chloroform. The stump assumed an unhealthy appearance, and sloughed. One large piece of bone came away. Amputation was a second time performed on board a ship at the Cape of Good Hope, April 13th, 1858, eight months after the accident. The stump has never entirely healed. Fort Pitt, June 11th, 1858. There is now considerable inflammation around the stump, particularly along its inner side, and the cicatrix is raised and œdematous. It is probable that the bone is again diseased. There was thick, purulent discharge from the stump, but he did not complain of pain in it. Appetite impaired, and bowels constipated; he is of a very strumous diathesis. On June 17th matter formed on the inner side of the stump: distinct fluctuation could be felt. On the 23rd the stump became suddenly very painful, redder, and more tense, and an incision was made into it, from which was discharged dark coagulated blood. He was in a very low, ænemic state. Oozing of blood took place from the stump, which was restrained by the

application of ice. He gradually became weaker, and died on June 27th. *Treatment.*—Nourishing diet, wine, quina, &c. To the stump, fomentations, poultices, cold applications, and ice, as the state of the case required. *Sectio Cadaveris*, twelve hours after death.—*Cranium.* Brain healthy. *Thorax.* Heart empty; blood pale, and destitute of red globules; lungs œdematous, but otherwise healthy. *Abdomen.* Convex surface of the right lobe of the liver adhered to the diaphragm by old bands of adhesion, and a few slight depressions, resembling cicatrices. The other viscera in this cavity were healthy, with the exception of being pale and bloodless; veins healthy. Stump tense and swollen, with several incisions on its surface, from two of which large coagula projected. The stump was of a very fœtid and gangrenous smell, and on cutting into it a very large cavity was found to extend from the extremity of the bone, up along its inner side, into the axilla, as far as the first rib, completely dissecting the axillary vessels and nerves, and likewise the muscles of the arm; the shoulder-joint was opened into by absorption of the capsular ligaments, the cartilage covering the head of the bone and glenoid cavity being discoloured by the blood, but not diseased. The vessels from which the blood was poured out could not be detected even by careful dissection, showing how difficult, or almost impossible, it would have been to find the bleeding vessels, or even the axillary itself, in such a case in the living subject. A small portion of the extremity of the amputated humerus was bare and carious, which probably was the origin of the deep-seated inflammation and suppuration, causing ulceration of one of the smaller blood-vessels, and consequent hæmorrhage, followed by a gangrenous state of the stump, and death from exhaustion. Preparation No. 3632. Stump of the right humerus after secondary amputation, resulting from a gunshot wound. The end of the bone shows that the medullary canal has not been closed, although nature has attempted to do so to some extent, and the end is partially rounded off; the shaft of the bone is roughened, particularly below the head of the bone, where it is denuded of periosteum, and is carious.

The following case shows anchylosis of the shoulder-joint after amputation of the upper third of the arm:—32nd Regiment. —Private John Day, wounded at Lucknow, August 27th,

1857, by a round shot, which carried away a great portion of the upper arm, shattered the humerus, and left the large vessels and nerves hanging loose. Amputation was performed by the circular method one hour after, under chloroform, at the upper third, close to the insertion of the deltoid. Exfoliation of the extremity of the bone took place, and it was extracted June 29th. August 16th, 1858.—Wound healed; cicatrix adherent to the end of the bone; shoulder-joint anchylosed, the result of the injury and surrounding inflammation. September 2nd, 1858.—Sent to modified duty.

Amputation of the Forearm.

The flap operation is generally to be preferred to the circular. The elbow being slightly bent, and the hand placed in a position between pronation and supination, a knife about six inches long should be passed across from one side to the other, so as to make a posterior flap, which should be raised, and a second similar in size and shape to that already made should be made on the anterior aspect of the limb; the two flaps should then be drawn up, and the textures close upon the bones, having been divided with the same knife, care being taken not to pass its points between them, the saw should then be applied close to the root of the flaps and the parts separated. When the saw is well used, there is little difference whether a single bone or both are cut at the same time. Several methods of holding the limb before transfixing have been recommended, but the chief thing to be observed is the attitude in which the limb is actually placed, so as to avoid passing the knife between the bone. The posterior flap is apt to be small, if the textures about to be transfixed are not grasped and raised above the blade.

Two flaps may also be formed by cutting from without inwards with a short straight bistoury.

When the incisions are made near the wrist, the tendons occasionally hang out of the wound, and require to be cut short. It is always well to endeavour to save as much of the forearm as possible, so as to admit of any kind of apparatus

being applied as a substitute for the hand. It is seldom that amputation of the forearm is required after wounds from musket ball, the shattered fragments are easily got at and removed, and the arteries can be cut down upon and secured without difficulty, except, perhaps, at the upper part of the forearm. Sloughing, from defect of nourishment, seldom takes place in the fingers as it does in the toes, when the great arteries are injured; consequently every effort should be made to save a forearm, however unpromising it may appear at first sight.

22 cases were admitted, of which 2 have been sent to modified duty, and 20 invalided. All have apparently been performed by double flap. 16 were done under the influence of chloroform; 15 were primary, and 4 secondary amputations; 4 in the upper, 11 in the middle, and 2 in the lower third. All were healed. In no instance was the integument adherent to the bone, and stumps were good.

Amputation at the Wrist-Joint.

When the hand is severely injured, and requires to be amputated, this operation may be performed in preference to that higher up through the bones of the forearm; still the length of the stump is of no great moment, especially as the flap, with its numerous tendons, is not so likely to heal, and therefore there is no great advantage to be derived from its adoption. This operation can, however, be performed on an emergency with the apparatus in an ordinary pocket-case, without requiring a saw; still a saw or a pair of forceps might be useful in cutting off the articular surface of the radius and projection of the ulna.

The hand being held in a horizontal position with the back upwards, a scalpel or large bistoury should be carried in a semilunar course down to the bones, from one side of the wrist to the other, about an inch and a half below the articulation. This flap should then be dissected up, and the posterior part of the joint opened; the ligaments on each side should next be divided, and then a flap similar in size and shape to the one already made, should be preserved from the front.

Amputation of the Thumb, Fingers, and Toes.

The following remarks upon amputation of the fingers and toes were published in the 'Medical Times' for May, 1848. Since then I have had frequent opportunities of seeing the advantage of the methods recommended, and therefore think that it will not be out of place to insert them here :—

"During the last seven years I have been in the habit of operating in the manner about to be described. None of the methods are strictly new, but are modifications of those generally performed. They appear, however, to possess several advantages.

"If a portion of a finger is to be removed at the articulations of the phalanges, a common, narrow, sharp-pointed bistoury is pushed from one side of the finger to the other in front of the joint and the flap made; the knife is now laid perpendicularly upon the lateral ligament, then brought across the joint, and the other lateral ligament cut. By this proceeding the joint is at once opened, and nothing remains but to divide the skin posteriorly. In amputating between the first and second phalanges, transfixion is made opposite to the large fold in the integuments in front, and the joint is at once come upon, as the two exactly correspond.

"The articulation between the second and third phalanges is one line in front of the fold. By cutting into the joint posteriorly there is always considerable difficulty in getting the knife between the bones, so as to make the flap in the palmar aspect. In consequence of the extensor tendon having been divided, the flexor contracts and drags the phalanx which is to be removed in front of the one which remains. The flap in the palmar aspect being made first, that difficulty is avoided, and the operation is performed with more rapidity and ease.

In removing the whole of the finger the method adopted is this :—The point of the knife is laid on the skin half an inch above the articulation, carried down straight over it, and then brought by the side of the finger into the large fold in front

and continued upwards on the opposite side to join the incision on the dorsum.

"This incision is performed by one continuous sweep from left to right without removing the knife. The finger is now pressed well out, so as to put the ligaments on the stretch, the joint entered, and the operation concluded. Having determined previously to remove the head of the metacarpal bone along with the finger, the same mode of proceeding is adopted, without, however, opening the joint. The incision is commenced on the dorsum, about an inch and a half above the joint, carried straight down, then brought round into the large fold in the palm, and continued upwards to where it began. The blade of the knife is now placed parallel with the metacarpal bone, and carried round its head from right to left, and brought back in the reverse manner, and the bone divided by the forceps. By this method there is no cicatrix in the palm, the flaps are smooth and regular, the operation is also quicker in its performance, and leaves a much better covering than by the mode usually followed.

"When amputating the thumb and metacarpal bone, the operator stands either on the inner or outer side of the arm, but I prefer the inner side, as most convenient. The point of a long narrow straight bistoury is entered opposite to the articulation of the metacarpal bone, and the trapezium passed under the adductors, and its point made to appear in the folds of the integuments betwixt the thumb and forefinger, and by cutting outwards a flap is formed. The knife is now laid upon the angle of the incision, between the thumb and finger, and continued over the dorsum of the bone to the part where it was to transfix. The thumb is then firmly grasped by the operator, and the soft parts divided down to the articulation, which is now disarticulated with great facility. The result of this operation is exactly the same as that recommended by Mr. Liston. One of the chief points to be attended to before commencing an operation is to have a good position for its performance. In Mr. Liston's method the surgeon stands in front, and is consequently very awkwardly placed for disarticulating the metacarpal bone; whereas, by standing behind, the operator has the power of putting the muscles and ligaments on the stretch, and dislocating the bone with great facility.

In some cases it is better to form a large flap on the fore part of the thigh, and a small one behind, but everything depends upon the condition in which the soft parts and bone are left after a gunshot or shell wound.

Sixteen different methods at least have been recommended, and any good anatomist and operator may disarticulate the head of the femur, and form his flaps either by the anterior and posterior, and by transfixion; or by making the flaps, by cutting from without inwards; the circular method has also been adopted by some, still, the flap is the operation generally preferred.

The patient having been placed on a strong table, and his breech brought close to its margin, and assistants properly placed—one behind the surgeon, to raise the flap and compress the artery, another opposite, to hold the pelvis steady, and a third, to hold the limb, &c.; but all this depends upon the surgeon's prior arrangements and means at his disposal. The limb may be removed by a dexterous surgeon in from fifteen to twenty seconds.

The point of a long catalin should be inserted midway between the anterior and superior spinous process of the ilium and trochanter major, and run across the fore part of the neck of the bone, and bring it out on the opposite side, about two or three inches from the anus. The surgeon should then carry it downwards and forwards, so as to cut a flap from the anterior part of the thigh, about four or five inches in length. During this part of the operation the limb should be raised, so as to relax the muscles and facilitate the passage of the knife. The assistant who stands behind the operator slips the whole of the palm of his hand into the wound, behind the knife, so as to grasp the whole flap, including the femoral artery; this may be done by either hand, but the right is generally to be preferred. The flaps being raised, the point of the knife should be laid against the head of the bone, and the anterior part of the capsular ligament divided. Should the femur be unfractured, the assistant who holds it should forcibly depress it, so as to make the head of the bone start from the socket; but this very rarely occurs in military practice, as in these cases the femur is usually fractured close to the trochanter. The knife is then brought behind the head of the femur, and carried downwards and backwards,

so as to form a flap about the same length as the anterior, and thus the entire limb is removed. The superficial femoral and other vessels having been compressed, are now secured as speedily as possible by ligature. The want of leverage in gunshot fractures of the neck of the femur makes it much more difficult to disarticulate the head of the bone. It might be more judicious in such cases, after having made the first and second flaps by transfixion (as in amputation of the thigh by anterior and posterior flaps), and then, if it were possible, to apply the saw to the bone above the fracture. If this cannot be done, the head of the bone should be dissected out, after the main portion of the limb at the fractured part had been removed, and the vessels secured. In certain cases it is impossible to determine the condition of the head and neck of the femur, and in these cases it is necessary for the surgeon to decide whether it would not be better to amputate through the trochanters, where the fracture has taken place, and afterwards to remove the head of the bone. The head of the bone, under these circumstances, can be seized by a pair of strong forceps, and turned in the required direction, so as to expedite the application of the knife to the capsular ligament, and afterwards a slight twist will cause its disarticulation.

The following case is interesting, as being, perhaps, the first successful case of amputation at the hip-joint after a gunshot fracture :—No. 2929.—Head of the femur removed by amputation at the hip at Brussels after the battle of Waterloo. The fracture extends obliquely downwards from the neck of the bone through the shaft, leaving the trochanter minor only attached to the head of the femur.—*Donor*, Mr. Guthrie, D.I.G. This specimen was taken from Francois de Gay, Private in the 45th Regiment of French Infantry. He was wounded at the battle of Waterloo by a musket ball, which entered behind, fractured the neck of the femur, and made its exit anteriorly, about four inches below the groin. He was admitted into the Elizabeth Hospital, July 5th, 1815, much exhausted. In addition to his wounds, which had put on a sloughing appearance, he suffered from an extensive sore on the sacrum, which was caused by lying on the wet ground for five days. Amputation was performed on the 7th, nineteen days after the injury. In Sep-

wards, so as to form a flap about four inches in length; then the knife should a second time be introduced in front, and carried downwards and backwards, making a flap similar to the first; both of them should then be drawn upwards by the hands of the assistant with considerable force, and then an incision should be made round the bone, about an inch higher than the place of transfixion; the saw should then be placed over this portion of the bone and the separation completed. When making the first entrance of the knife by transfixing, the point should be thrust down perpendicularly to the bone, with which it should be kept in close contact as it is carried round to the opposite surface. The first flap should not be firmly elevated by itself, as the knife is thereby prevented passing readily round the bone, to form the second flap; but when both are formed, they ought to be forcibly held up so as to allow of the free application of the saw without rubbing against the soft parts.

Circular operation.—This may be performed on any part of the thigh, and I have seen as good stumps (after eight or ten months, and even years), after this method, as from the flap operation. Several of the cases from India were good examples of the circular method.

The femoral artery is commanded either by the thumbs of an assistant or by the tourniquet, and it is of no consequence in the flap operation, when the surgeon has confidence in himself and his assistants, whether the inner or outer flap is made first; he could in any case grasp the limb, and thus arrest the bleeding by one hand, and with the other he could seize the vessels by the forceps.

After any of these operations, the first thing to attend to is the femoral artery; when the transfixion is from the outside, sometimes the artery is split for an inch in length. In such a case it should be cautiously separated from the vein and drawn out of its sheath before the ligature is applied; but usually it is not difficult to discover. In some cases two or three vessels will require to be tied, in others ten or twelve. Venous hæmorrhage sometimes takes place, but usually stops when the pressure in the groin is taken off, and almost always when the flaps are placed together.

Fifteen have been admitted, 14 invalided, and 1 died;

1 only occurred in the upper third, and 14 in the middle third. All appeared to have been flap operations, and performed under the influence of chloroform. In 8 instances the integument was not adherent to the bone, and the stumps were very good. In three cases the skin adhered very slightly, but the covering was still good. Three cases remained unhealed. The case at the upper third of the thigh was performed by anterior and posterior flaps, forty-six days after, under chloroform. The wound healed; stump good, and skin not adherent. The stump was so short that it could not be retained in the bucket made by Mr. H. Bigg. In 8 cases amputation was performed from one to twelve hours after the accident; in 1 case from one to two days; in 1 case from three to seven days; in 1 from eight days to one month. Four were apparently by lateral flaps, and 6 were by the anterior and posterior flaps, and in the other case the mode of operating is not stated.

The following case, from India, is an example of extensive necrosis of the shaft of the stump of the femur, causing death from exhaustion:—2nd Battalion Rifles.—Private John Sole, æt. 24, wounded November 28th, 1857, at Cawnpore, on the right leg, by a grape shot. Amputation was immediately performed at the middle of the thigh. He was admitted into Detachment Hospital, Gravesend, on July 8th, 1858, from on board ship. He was much emaciated. The stump had never been properly healed, and on board ship it sloughed. There were several unhealthy-looking sores on the stump along the line of incision, with a profuse discharge. After being in hospital he improved considerably, sores appearing more healthy, and for a time he gained both flesh and strength. He occasionally complains of great pain in the stump, referring it to the end of the bone. About three weeks before his death a swelling of considerable size appeared on the outer surface of the stump, which burst, and a large quantity of unhealthy pus escaped, and dead bone was detected through the newly opened sore. He now began to lose flesh and strength; the discharge increased from all the sores, appetite bad, stomach very irritable, and bed-sores appeared. He died on September 11th, 1858. All the viscera in the different cavities were healthy. The

of testing great surgical questions, if they were on all occasions to rest satisfied with either their own preconceived opinions or the diction of others." To avoid copying Mr. Fergusson's remarks at length, I shall only refer to them at page 500 of his work.

Mr. Syme's observations on this operation, published in the 'London and Edinburgh Journal of Medical Science' for May, 1845, are worthy of the attention of the profession, as all his remarks are. Mr. Fergusson's concluding remarks are these—"There are many instances of incurable disease of the knee-joint where the serious mischief is limited to little more than the articular surfaces; in such cases, however great the surrounding swelling may be, as also in all examples where the whole of the leg must be sacrificed either for injury or disease, Mr. Syme proposes to substitute this operation for the proceedings hitherto performed higher up; and in several cases of the kind which he has published, and many occurring in my own practice, the results have been so satisfactory that I am disposed to consider the operation well worth the attention of the profession; I should also say both in civil and military practice.

Amputation of the Leg.

This operation may be performed in any part of its extent, but it is usual in hospital practice to amputate in the upper third, so that patients in this walk of life may have a cheaper and perhaps a more serviceable wooden leg, where the body can be supported on the knee in a bent position; while in patients in better circumstances, and with any other substitute resembling an artificial leg and foot, it is occasionally preferable to amputate at the lower instead of the middle or upper thirds of the leg. When the knee has to be kept bent, a long stump projecting behind is very inconvenient and apt to be injured. In cases where it is wished to keep the knee straight, and an artificial foot applied, a light and efficient apparatus, at a low price, can be obtained at any of the instrument makers.

It is at the present time the general practice to amputate at

the middle of the leg, with the object of continuing the movements of the knee-joint, or the patient could rest on the knee bent, and the projection behind would not look unseemly, and the stump would also be long enough to allow of an artificial leg so as to use the joint, and this is the operation which should generally be performed in military practice when the foot or ankle-joint has been fractured or injured. When in amputation at the lower third, patients can be provided with a good, well-made wooden leg, so that the patient can walk many miles a day without much inconvenience; this apparatus is, however, somewhat more expensive than when the patient has to rest upon the bent knee. On the other hand, when an amputation has been performed in the middle of the leg (which is the site generally recommended), the stump is made of such a length as to fix into the socket of an artificial leg and foot. Should it be found that the weight of the body cannot be sustained in this way, he can have an apparatus so that he can rest on the bent knee, and the projection behind would be such that little notice would be taken of it. When the surgeon has the option, he should prefer operating about the middle of the leg, where he is certain to find plenty of soft parts to form a covering for the bones, whereas, if the operation is performed near the ankle, there is a chance of a deficiency of covering.

Flap operation in the middle of the Leg.—This may be performed in the following manner:—The patient should be placed on a firm table, and held by assistants, one of whom should have charge of the flap. The femoral artery should be compressed on the brim of the pelvis, by placing two thumbs upon it, and grasping the thigh at the same time; or a tourniquet can be applied with a common hard calico roller placed parallel with the course of the artery, when the requisite amount of pressure can be made by turning the screw.

One method is, the surgeon passes an amputating knife from one side of the limb to the other, close behind the bones, and forms a flap from the calf of the leg, about three or four inches in length, according to the size and shape of the parts. The knife should then be drawn across the front of the limb with a semi-lunar sweep between the points he has already transfixed; the flaps should then be drawn up, and the bones cleared of the soft

parts as high as possible, the saw applied, and the separation completed.

The second method looks better during its performance, and is done with one continuous cut without removing the knife, and is the course generally adopted. Supposing amputation has to be performed on the right leg, the surgeon grasps the fore part with his left hand, and having ascertained the margins of the tibia and fibula, the point of the knife should be inserted on the posterior margin of the fibula, and carried upwards for about an inch, and then brought across to the inner margin of the tibia (so as to make a small semilunar flap in front), where transfixion should next be made behind the bones, taking care not to get the knife between the tibia and fibula, and a posterior flap formed; the bones are then cleared and sawn across, as in the previous method. The crest of the tibia should also, in the generality of cases, be sawn obliquely off, else it is very liable to cause ulceration of the skin in front, and to become necrosed. A great deal has been said as to the side where the surgeon should stand, and it appears to me to be a matter of indifference whether the outer or inner is selected; but when once the surgeon has taken up his position, he ought to remain and not change it after having made the flaps, to the other side, to saw the bones. For my own part, however, I prefer standing on the inside on amputating either leg, as the fibula is easier got at and sawn before the tibia. In using the saw, the hand of the surgeon should always be above the level of the blade, and the cutting edge placed obliquely, so as to gain an efficient attitude for sawing the two bones. By standing on the outside it is rather awkward to cut the fibula first, and obliges the surgeon to depress his hand to a great extent. But, in reality, with an operator of moderate dexterity, it is of no great importance whether the small bone is sawn across before the larger or not.

When the amputation is very high, it is necessary to see that the saw is of sufficient breadth, as the tibia in this situation is of considerable thickness. When the bones are sawn separately it sometimes happens that the fibula is left a little longer than the tibia; this should be carefully avoided, for the projection will not afterwards admit of pressure on the stump. In cases of amputation close to the knee-joint, it has been proposed to re-

move the head of the fibula, so as to form a better stump, but in consequence of the frequent occurrences of inflammation and suppuration within the knee-joint following, it is not now usually adopted. The junction of the synovial membrane of the knee-joint with that of the fibula does not usually take place (as I have repeatedly verified by dissection), still, they are so close to one another that the knee-joint may be easily opened, in disarticulating the head of the fibula, and, therefore, unless it is much shattered it should not be removed. When the limb is very muscular, a fleshy mass, formed chiefly of the gastrocnemius and soleus, is soft, which is with difficulty covered with skin, the former retracting more readily than the latter. Although it may look unsurgical, it would be well in such a case to cut a slice from the muscular part of the posterior flap, so as to bring them down to the level of the skin. This is more liable to occur in military than in civil practice, where the patient is in rude health, and the other emaciated from disease of the joint and long illness.

The small anterior flap should be of such a size that there would be no chance of the cicatrix being more in the centre of the stump than on the front. As a general rule in all cases, it is better to preserve a little too much rather than the least portion too little, as it will soon be found, in about six months after amputation, that what looked clumsy and too big at first, has become a very appropriate and good stump.

Twenty-one were admitted, and 21 were invalided. 11 were performed in the middle third, 4 at the upper third, and 2 at the lower third. 15 appeared to have been performed by the usual flap operation, but in 2 of them a large anterior flap was also made of integuments, in one of which the stump was good, and in the other the skin was adherent. 2 were by the circular method, and in both of them the skin was adherent; but still these two stumps were as good as any of those by the flap. 14 cases were operated upon under the influence of chloroform, and 3 without it. In 8 instances out of the total 21 cases the integuments were free, and movable over the crest of the tibia. In 3 cases only were the stumps unhealed. 16 were primary, and 2 secondary amputations.

The following is an interesting example of the foot having

been shattered by round shot, requiring immediate amputation, and where there also existed a simple fracture of the femur of the same thigh, which was not discovered for six weeks after. 78th Regiment.—Private Duncan McCrea, æt. 36, wounded September 24th, 1857, at Lucknow, by a round shot striking the left foot, and carrying it away; at the same time he received an oblique fracture of the lower and middle thirds of the same thigh, which was not detected for six weeks after. The leg was amputated four inches below the knee, by the flap operation, about a quarter of an hour after, under chloroform. June 11th, 1858.—There is now a good stump, and the skin does not adhere to the bone. The femur appears to have been fractured obliquely, commencing about four inches above the knee; one extremity of the bone is found to project in front, and a groove is felt to proceed upwards and backwards to the posterior part of the middle of the femur. The knee-joint cannot be completely extended or perfectly flexed, so as to fit a leg stump, in consequence of the contraction of the rectus and vastus muscles. The left femur is an inch and a half shorter than the right, and he states that it only united on the pssaage home. —Invalided August 18th, 1858.

Amputation at the Ankle-joint.

This operation had not received much attention until of late years, when Mr. Syme brought it into notice and gave the result of his experience. The object of this operation is to retain the skin from the lower part of the heel, as it is most likely to form the best cushion for the body to rest upon, although the heel bone is removed.

The merit of having first (in 1842) performed this operation is entirely due to Mr. Syme, the celebrated Professor of Surgery in the University of Edinburgh. Since then he has published many cases, which have fully established the success of this method.

The operation is performed by Mr. Syme somewhat in the following manner:—A semilunar incision is made across the instep from one malleolus to the other, and then the knife is

carried across the sole of the foot, the point of both incisions meeting in front and a little below the malleoli. The soft parts are further divided and detached in such a manner as to allow of the removal of the foot; lastly, the saw is applied to separate the malleoli, and, if necessary, a thin plate of the articular service of the tibia. The tibial and other arteries are secured, and the flap is brought up from the sole of the foot against the ends of the bones, and the wound treated in the usual manner.

This operation is much more difficult than amputation in the leg; but it has such great advantages that, whenever it is practicable, it should be performed. To disarticulate and to separate the skin from the projecting part of the os calcis is a very tedious and protracted dissection, and very frequently the integuments covering the heel are cut; but this is not of much moment, as an opening is rather an advantage than otherwise, as it allows the free escape of pus, should any form. Occasionally sloughing takes place in the posterior flap; but this does not in general cause much annoyance. Care should be taken to preserve the posterior tibial artery, so that it may not be cut across at the upper angle of the flap, and also at its final division in the sole of the foot, so that there may be a sufficient supply of blood for the flap below.

This operation is suitable for gunshot wounds of the tarsus and compound luxation of the ankle-joint, as well as for disease of the joint; and even when the ankle-joint is the principal seat of disease, this operation can be performed, as it is seldom that there is more than a thin layer of the articular surface of the tibia affected. This operation has many advantages; it gives length of limb and stump, and a most perfect covering to the ends of bones, and likewise a good artificial foot can be applied, which will look more seemly than a wooden leg.

It sometimes happens after this amputation, as after others in the long bones, that disease may arise in the osseous surfaces where the saw has been applied; in such a case the cicatrix may be opened up and a part of the bones sawn off.

Pirogoff has recommended that the same semilunar incision should be made in front of the joint and disarticulation affected, and an incision made across the sole of the foot, connecting the

extremities of the anterior flap; afterwards the saw should be applied so as to take away a thin slice of the tibia and fibula, and likewise about half the os calcis, as the case may require, leaving the heel or end of the bone attached to the soft parts. The chief advantage of this method is that the surgeon avoids the tedious and rather difficult dissection round the head of the calcaneum.

One case of amputation at the *ankle-joint* was performed, eight hours after the accident, in the 75th Regiment; and a very good stump resulted.

With regard to the respective merits of the two methods of amputation at the ankle-joint, viz., that recommended by Mr. Syme, and that by Pirogoff, the profession has not yet come to a decision. Still, there appears to be some advantage in the latter, as being easier of execution, giving a longer stump and firmer support. In Pirogoff's operation, when the ends of the tibia and fibula are sawn straight across, there is always great difficulty, or rather almost an impossibility, in bringing the calcaneum into apposition with the end of the tibia; so that it has been found necessary to remove several slices of the calcaneum with a strong bistoury before the bones could be brought to fit properly. To remedy this difficulty, the following modification was adopted in a case operated upon by me, on the 24th December, 1858, at Fort Pitt. The articular extremities of the tibia and fibula were sawn off *obliquely*, the thick part of the *wedge-shaped pieces* being *posterior*. The os calcis fitted admirably. The wound healed rapidly, and a very good, solid stump resulted. The *sawing* of the *ends* of the *bones obliquely* is an improvement, and is well worthy of being generally adopted, as allowing of easy adaptation of the calcaneum to the ends of the leg bones.

Partial Amputations of the Foot.

Chopart's operation consists in the division being made between the astragalus and calcaneum on one side, and the cuboid and scaphoid on the other. The surgeon places the palm of his hand on the front of the dorsum of the foot

and feels for the projection of the scaphoid, which is the only prominent part which can be referred to as a guide; but these joints are so easily opened that there can be no difficulty in accomplishing the operation. A semilunar incision should be made across the dorsum of the foot, the ligaments kept upon the stretch by forcible depression by the left hand, and the joints entered and disarticulated, and a large flap formed from the lower surface of the foot, the incision being extended as far as the ball of the toes. In many cases it is advisable to saw off the exposed articular surfaces of both the astragalus and os calcis, otherwise exfoliation of the extremities of these bones is apt to take place, and there is also a danger of the flap not being sufficiently large to cover the bones.

Hey's Operation.—The surgeon should grasp the foot firmly with his left hand and find out the projection of the metatarsal bone of the little toe, and also of the internal cuneiform; he should then make a semilunar incision from the one point to the other across the dorsum of the foot; the toes should be well pressed down, so as to put the ligaments on the stretch, and then run the knife back again along the dorsum and the articulations entered, and, finally, a long flap formed from the sole of the foot. In disarticulating, it is usual to insert the knife perpendicularly, so as to divide a very strong ligament situated between the internal cuneiform bone and second metatarsal. The internal cuneiform bone projects to such an extent that it is advisable to cut it off with the forceps or saw.

This and Chopart's operations are much to be preferred to the more extensive mutilations at or above the ankle. Occasionally the heel is drawn backwards and upwards, particularly in the case of Chopart's operation, and the weight of the body is thrown on the cicatrix and on the anterior ends of the bones; but if the stump is kept in a good position during the dressing, there is not much cause for anxiety.

In performing these operations, the foot can also be transfixed by a catalin and the flap made first, and then the semilunar incision is made in front and the joints opened; but methods previously described are much more preferable. The great object in all these partial amputations is to save as much of the foot as possible, whether it is through the articulations

or by sawing through any of the bones, so that plenty of flap or covering can be preserved.

Three cases of amputation through the medio-tarsus arrived from India. In one the operation was performed three hours and a half after the injury, caused by a musket ball through the arch of the foot. In the other the operation was performed twelve days after the accident. In both cases the stumps were good. In a third case of Chopart's operation on the foot, the heel was very much carried backwards, so as to bring the line of incision nearly on to the ground when the man attempted to put the stump to the ground to use it in progression. The tendo Achillis was divided, and the heel brought forcibly downwards, so that the weight can be taken upon the extremity of the os calcis, and a boot with an apparatus, so adapted as to prevent a return to the faulty position, has been applied. The astragalus appears to have been removed in this case; but it was sent home from India as a Chopart's operation.

Amputation of the Toes.

The remarks made under the head of amputation of the fingers are applicable to the toes, and the same oval method should be adopted; and any surgeon can so form his incisions for any particular case, only always bearing in mind that it is necessary and incumbent upon him to preserve as much of the foot as possible, having at the same time a due regard to the removal of the whole, injured, or diseased parts.

CHAPTER XIX.

EXCISIONS.

Superior Extremity.

Three cases of resection of joints have arrived from India, viz., one of the shoulder, and two of the elbow-joint.

Out of a total number of 36 primary resections that occurred in the Crimean war—of which 28 were performed on the superior, and 8 on the lower extremity—of the former 6 died and of the latter 4 died, viz., 4 cases of excision of the head of the femur.

Excisions are seldom required in either clavicle or scapula; portions of caries or necrosed bones can be removed by gauge or forceps.

Shoulder-joint.*

When the soft parts are not extensively lacerated by gunshot, this operation can be practised with the best results. When the head of the bone is shattered, the operation can be performed in the following manner:—The patient being seated, or laid on a table with his shoulders raised, a semilunar incision is made with a strong bistoury, commencing opposite the coracoid process, and ending about an inch behind and below the root of the acromion, and thus forming a flap of nearly the whole of the deltoid. It is dissected upwards, and then a firm incision is made through the tendons attached to the tuberosity on the humerus and capsule,

* I beg to refer to "Gunshot wounds with direct penetration and perforation of the larger joints," for further information on this subject.

of the joint, to such an extent as to admit of the shattered fragments being removed, either by the forefinger or strong forceps. When the operation is for disease, the head of the bone can be turned out of its socket, by a slight twist of the arm below. The arm should be held steady, and as much as is deemed necessary should be removed by the saw. The injured or diseased portions having been taken away, the glenoid cavity should be carefully examined, as also the acromion and the diseased parts scooped out with gouge or cut off with pliers. The principal vessel requiring ligature is the posterior circumflex. The flap should now be let down and the edges stretched, and the arm retained in a sling. Afterwards the joint becomes stiff, or partially anchylosed; still, there is such free play of the clavicle and scapula, and also of the articulations below, that a useful and even ornamental extremity remains, instead of a mutilated trunk.

The surgeon should not limit himself to one mode of procedure, but trust to his anatomical knowledge and operative skill, and adapt his measures to the peculiarities of the case. Flaps may be made of any form, and the surgeon has the option of cutting in any direction where there is no fear of coming in contact with any large vessel or nerve.

Only one case of resection of this joint was admitted from India; but there is another case where a secondary operation was performed at Fort Pitt, in a patient who is returned as a wound of the joint.

In the Crimean war the head of the humerus was removed twice as a *primary* operation during the first period of the war, or that ending March, 1855, and eight times during the second. One of the two first mentioned ended in death, and of the eight subsequent operations only one proved fatal.

"The head of the bone was five times removed as a *secondary* operation, without a single casualty, all the cases except one making good and comparatively rapid recoveries. In addition to these, there was a case in which the head of the bone and a large portion of the scapula, broken into fragments, were removed."

"Out of the total number, then, of 16 cases, 3 deaths took place, or 18·9 per cent. Had this operation not been resorted

to, amputation at the shoulder-joint, it is believed, would have become necessary in all."

Nineteen cases of resection occurred during the Schleswig Holstein war. Of these, 7 died, and 12 recovered with useful and movable articulations. Of the 7 fatal cases, 2 were primary operations, 2 were performed during the reaction stage, and 3 were secondary resections.

This mortality at first sight appears rather high; but the conditions under which they were performed must be taken into consideration: they were done, as Esmarch states, under circumstances in which more than a third of all amputations of the arm died. They died of pyæmia. Stromeyer and Esmarch both agree that the most favorable time for resection is either within the first twenty-four hours, or when suppuration is fully established.

Abscesses and sinuses are apt to form in the vicinity of the joint, and occasionally cause considerable trouble. A good deal of this depends upon the form of incision selected, so as to allow of the free discharge of pus. Bandens, who has had great experience, recommends the straight incision, so as to avoid cutting the fibres of the deltoid, and it is also necessary to save the long tendon of the biceps, if possible.

Stromeyer advocates the semicircular incision over the posterior surface of the joint, which certainly allows of the free exit of pus; but to cut across the fibres of the deltoid must in some degree impair the limb, although Esmarch states that to cut across the fibres of the deltoid does not much interfere with its after usefulness. Even in those cases where the single incision has been employed, the patient frequently has very little or no power of raising the arm from the side, as was exemplified in the case of Private James M'Donald, 79th Regiment, from the war in India, and others that have come under notice here.

As there are generally two apertures, the surgeon may wish to include them in his incision; but each method will possibly be found to suit in different cases. It is seldom necessary to take away more than the head and a portion of the shaft—perhaps nearly as low as the insertion of the deltoid; but in the Schleswig Holstein war it is shown that as much as four

inches and a half were removed from the humerus, and yet a most useful arm remained.

Esmarch makes the following observation:—"It is curious that the operation on the left side seems to give less favorable results than on the right. 6 of 12 died of those resected on the left; 1 out of 7 of those resected in the shoulder on the right side. A similar proportion held good in resections of the elbow, in whom, of those operated upon on the left, 4 in 19, on the right 2 in 20 resections proved fatal. From this, the fatality attending operations on the left arm to that on the right is as 3 to 1; but of course further observations are required to enable conclusions to be deduced."

The following is a primary case of excision of the head of the humerus by one straight incision from India:—Private James M'Donald, 79th Highlanders, wounded at Lucknow, March 11th, 1858, by a musket ball, which struck him in the left shoulder, splintering the head and shaft of the humerus to a considerable extent. The ball then passed backwards and downwards, injuring the lower angle of the scapula, and lodged between that bone and the ribs, from which position it was extracted. The shattered parts of the head of the humerus and part of the shaft were excised the same day, by one long incision through the anterior part of the deltoid muscle. September 26, 1858.—There is a large cicatrix in front of the shoulder-joint, and a sinus in its centre, leading down to diseased bone. He cannot raise the arm from the side, on account of loss of power over the deltoid. He has been sent to modified duty, December 22nd, 1858.

The two following cases of secondary operations are good examples of perforating gunshot wounds through the head of the humerus, followed by anchylosis of the joint, and the track of the ball remaining carious, necessitating resection of the head of the bone:—

93rd Regiment.—Private John Frazer, æt. 33, seventeen years' service. Was wounded at Lucknow, March 14th, 1858, by a musket ball, which entered the left shoulder beneath the acromion, and passed backwards, apparently through the humerus close to its head. March 2nd, 1859.—There is now anchylosis of the shoulder-joint. Much dead bone in frag-

ments can be felt both from the anterior and posterior openings. General health good. 17th.—The head of the humerus was excised, and it shows the track of the ball to be in a carious state. Numerous smaller pieces were also taken away by the gouge.—Invalided.

9th Regiment.—Private John Morgan, æt. 39. Eighteen years' service—ten of them in India. Was wounded in action at Idaliff, in September, 1842, the ball passing through the right shoulder-joint and injuring the scapula. On admission into Fort Pitt Hospital, June 9th, 1844, there were three sinuses, two on the anterior aspect of the joint, one opposite the coracoid process, where the ball entered, and the other at the lower border of the axilla, and another on the posterior aspect, the exit of the ball, each communicating with diseased bone. Excision was performed on June 22nd, 1844, by me; a semilunar flap was made of the deltoid, embracing the entrance and exit of the ball; and on attempting to dislocate the humerus, this was found impossible, on account of complete anchylosis of the joint. The humerus was sawn across about two inches below its head, then cleared of soft parts, and raised; its attachment to the glenoid cavity was broken down by means of cutting pliers. The wound healed quickly, and he gradually regained the powers of motion in the arm. No. 2919. Head and neck of the right humerus, which was excised on account of caries consequent on a gunshot wound. The large, deep groove is the track of the ball; it is carious a little below the groove. There is an aperture, about one fourth of an inch in diameter, situated on the inner aspect of the bone, leading into the medullary cavity. The tubercles and upper part of the shaft are enlarged from depositions of new osseous matter.

Excision in any part of the shaft of the humerus is seldom required, but should it be necessary, there can be neither difficulty or danger in doing so by making an incision on the outer or posterior surface of the arm.

Resection of the Shaft of the Humerus.

The following preparation, where three quarters of an inch of the shaft of the humerus were resected in a case of comminuted fracture eight months after the injury. Death from pyæmia one month after the operation:—No. 2920. Humerus exhibiting a gunshot fracture below its centre. The end of the lower portion is healthy. There is a superficial exfoliation of a large portion of the outer layer of the shaft of the superior fragment, and also of the medullary canal.—*Donor*, C. Reade, Staff Surgeon, 95th Regiment. —Private Thomas, æt. 22 years, when on duty in the trenches before Sebastopol, was struck by a fragment of shell on the left arm, producing a compound comminuted fracture of the humerus, an inch below its centre, August 18th, 1855. On admission into Brompton Hospital, February 18th, 1856, the wound had healed, but re-opened on April 18th. At this time firm ligamentous union had taken place between the ends of the fractured bone, and a false joint had been established. On April 22nd he was in an excellent state of health. It was determined to perform the usual operation for effecting union of the shaft of the bone. A free and deep incision was made in the outer aspect of the left arm, about an inch below the insertion of the deltoid muscle, and carrying it perpendicularly downwards to a level with the condyles, dividing, amongst other muscles, the outer belly of the triceps. Owing to the obliquity of the fracture, and the strength of the ligamentous structure holding the bones together, some difficulty was experienced in passing the knife through the ends of the bones. After further dissection, three-quarters of an inch were sawn off with a metacarpal saw from the fractured ends. There was but little blood lost during the operation, though several ligatures had to be applied. The patient was under the influence of chloroform. Some considerable time after, he was removed to his ward, and reaction had taken place; profuse hæmorrhage occurred from the wound, probably from deeply-seated muscular branches, but was stopped eventually by the application of ice. The limb was placed in a gutta-percha splint. On the evening of the following day the

patient was feverish, with hot and dry skin, quick pulse, flushed face, and great thirst. He went on favorably till the 27th, when he had an attack of what is described as intermittent fever. On the 30th he was improving in health, the wound contracting and granulating. Discharge profuse, but healthy. On the 1st, 2nd, and 3rd May he was slightly delirious, and so restless that the limb was constantly disturbed. On the 4th severe dyspnœa came on. The wound still continued to contract, and the discharge was healthy. On the 8th he had a slight attack of shivering. All the ligatures came away. Continued to gain strength up to the 17th. His appetite was enormous; bilious vomiting came on, owing, as was supposed, to the mixture of some incompatible articles of extra diet. On the 19th he passed a restless night. The vomiting stopped, but there was a good deal of nausea. Had a severe attack of dyspnœa, with short cough, and symptoms of congested lungs, especially of the left. Tongue furred; disharge from the wound less. The cough and dyspnœa more severe, and the heart's action very rapid. These symptoms continued to increase, especially those of pericardial effusion, and he died on May 21st. *Sectio Cadaveris*, thirty-three hours after death.—Pericardium contained two pints of turbid serum, and was coated with a thick layer of recent effused lymph of a granular appearance, with several patches of vascularity. Valves healthy; both lungs congested; liver healthy. An abscess was found in the external margin of the spleen. *Left Kidney.*—There was an abscess, about the size of a walnut, on its upper and inner surface, immediately below the capsule. There was also a similar abscess in the right kidney. Stomach and intestines healthy; veins not examined.

In the case of Major M., recorded under the head of "Fracture of the Humerus," resection may also ultimately be required.

Excision of the Elbow-joint.

It is generally the plan in the present day, where there is the slightest chance of saving any portion of the superior extremity, never to perform amputation; and this is more especially the

case in gunshot injuries and disease of the elbow- and shoulder-joint. Amputation of the arm, or any part of the upper extremity, can be performed by any surgeon, and is much more easy; but when once done, it cannot be replaced, and no artificial contrivance can ever be compared to those preserved after successful excision of the elbow or shoulder, whatever may be its condition, either as to its appearance or usefulness.

This operation is always done on the dorsal aspect, on account of all the large arteries and nerves, except the ulnar nerve, lying in front. The patient is either seated on a chair, or laid on a table, with his face downwards. The attitude having been fixed upon, the arm and forearm should be firmly held by an assistant, with one part on the humerus, and the other on the forearm; and either a crucial incision, or one in the shape of the letter H, should be selected; the latter is generally chosen when much space is required for the removal of the injured or diseased bone. On the flaps being raised, the olecranon will be laid bare, and the ulnar nerve must be carefully dissected out of its position, behind the internal condyle, and held aside with a blunt hook during the future steps of the operation; the attachment of the triceps should next be divided, and the cutting forceps used to separate the olecranon from the ulna; or, in gunshot injuries, the fractured parts can be removed by the fingers or forceps. The surgeon will now be guided as to the future steps by the apparent extent of injury or disease. The diseased or injured portions of the radius and ulna, and also of the humerus, can be removed either by the gouge, forceps, or fingers, and the saw may also be requisite to take away a portion of the articulation of the humerus. In all cases of extensive injury or disease, the lateral ligaments must be cut across, to allow the ends of the bones to be turned out. Caries is generally limited to the articular surfaces or their immediate vicinity; but in the performance of this operation, it is very necessary to distinguish between caries and that enlarged condition of the bone in the immediate neighbourhood of the disease which should be allowed to remain, as this arises from an excess of vitality, as shown by the formation of new bone, while there is the lowest amount of it in the parts denuded of cartilage. A splint should be worn at first on the inside to

keep the arm steady, but in the course of a few weeks a little motion should be encouraged.

Two cases of excision of this joint arrived from India, and are interesting. In one there had also been a fracture of the humerus, and the arm is now in an extended position, and the motion of the elbow-joint is very limited; in the other, the arm hangs powerless by the side, like a flail, without strength to raise the forearm, and he can only move the thumb and fingers slightly; it is so useless and cumbersome, that he has frequently requested me to amputate the arm; this has not been done, because, when he keeps the arm in a sling, he has still the use of the fingers and thumb. In this case a very large extent of the ends of the bones of the elbow-joint must have been removed, and also the tubercle of the radius, with the attachment of the biceps; the distance between the bones is very great, and there does not appear to be ligamentous matter effused between the bones. The man himself, when out of hospital, does not use the sling; consequently, the arm is so much in his way that he fell down when under the influence of liquor, and injured it very much. In both these cases the operation was performed by the H incision.

The extent of the articular ends of the bones that can be removed, compatible with a useful limb, should be such as to allow of free motion between the ends of the bones, so that there can be no fear of their becoming jammed. It appears that about one inch, or one inch and a half, of all the three bones composing the joint, should be always about the extent removed.

When only a small extent of the articular ends of the bones is removed, anchylosis is almost certain to be the result, from the extremities of the bones becoming jammed, and preventing free motion even from the first.

Partial resection of the shoulder and elbow-joints does not permit of nearly so much motion as where the entire articular surfaces are removed, and they generally terminate in partial or complete anchylosis, as occurred in a case on which I operated lately; and there is one arrived from India, where the joint is anchylosed, with the arm in a straight position, and hanging quite useless by the side, but, as already stated, there was also a fracture of the humerus in this instance.

In all cases of gunshot wounds of the elbow and shoulder-joints, where there is direct injury of the capsule, with fracture or splintering of the bones forming the articulation, primary resection should, as a rule, be performed on every occasion, as being more certain to terminate in a speedy cure, and to leave a much more useful limb, with a good artificial joint, than where the case is left to nature, when the track of the ball and joint itself generally become carious, and continue to discharge for years, ultimately requiring resection to be performed.

The cases of Frazer and Morgan are examples of the above remark in reference to the shoulder-joint; and there are several cases of wounds in the elbow and shoulder-joints from India, where complete anchylosis had taken place, and which would have had much more useful limbs, had excision been performed with the usual amount of success.

5th Regiment.—Private Thomas Johnstone, æt. 30, wounded at Mussleagh, by a sword-cut, in five different places, March 19th, 1858. One wound opened freely into the right elbow-joint, and severely wounded the radius and humerus, necessitating excision, by the H incision, of this joint, which was performed two days after; this had been deferred until then, on account of the movements of the forces. Another shot carried away the left thumb, which was amputated. September 26th.—The arm hung powerless by his side, and he has not the power of raising the forearm; he can use his fingers; the ulnar nerve seems to have been injured, as he has not the feeling of the ring and little fingers; when his arm is supported in a sling he will still have a useful forearm. Invalided December 29th, 1858.

75th Regiment.—Sergeant John M'Donald, æt. 26, wounded at Delhi, June 15th, 1857, by a musket ball, in the posterior part of the left elbow-joint. Excision, by H incision, of the fractured parts was immediately performed; several pieces of bone came away at the time, and several pieces came away afterwards. July 20th, 1858.—Wound healed; arm in an extended position, and can be only slightly bent; he cannot open the little and ring fingers, and the others are also powerless. The arm is about three inches shorter than the right. September 8th.—Sent to modified duty.

In the Crimean war "22 operations in all were done on the elbow-joint, of which 3 ended fatally, and 2 more deaths took place after secondary amputation; in all, a total of 5 deaths, or 22 per cent. of the cases treated. This per-centage slightly exceeds that of resection of the shoulder-joint, but in both instances resection afforded a much more favorable result as to the mortality than amputation."

Excision of the entire Ulna and the whole of the Articulation of the Elbow-joint.

In the following case, on which I recently operated on account of disease — and where I took away the whole of the ulna, two inches of the humerus, and the head and neck of the radius close to the tubercle—the man can now (four months after the operation) bend his forearm, raise his hand behind his head, and lift a twenty-eight pound weight from the ground; he can also pronate and supinate the hand; there is no anchylosis of the wrist-joint, and he can use his fingers well.

This case also shows the large amount of bone which can be removed from the *upper extremity* compatible with the patient regaining a very useful arm and hand; and although not resulting from a gunshot wound, still it appears of sufficient interest to be given here.

Staff Armourer Sergeant H. W—, æt. 26, two years and a half in the service, of which five months were in China. He is of healthy appearance. Was admitted into the General Hospital, Hong Kong, in August, 1857, immediately after his arrival from England, with symptoms of acute hepatitis and pleuritis. Active depletion was had recourse to, and calomel and opium administered, which produced salivation, and the disease was arrested; on the 3rd of September a large phlegmonoid tumour was found near the elbow-joint, which was opened, and a large quantity of matter evacuated. From that time the ulna became permanently enlarged, extensive necrosis took place, and a few spiculæ of bone came away. He was admitted into Fort Pitt Hospital on the 1st of August, 1858, with numerous sinuses along the inner side of the left ulna, extending down to

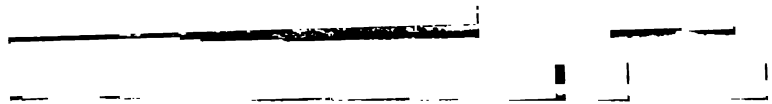
the diseased bone, and the probe also entered from behind into the elbow-joint. The disease in the ulna was imagined to terminate about an inch above the wrist, but to extend into the elbow-joint. The radius did not appear to be engaged in the disease. The patient's general health was good. August 30th.—The whole of the ulna, as well as an inch and a half of the extremity of the humerus, and also the head and neck of the radius, were removed by a single incision along the posterior and inner side of the forearm by me. The skin was dissected back, and the ulnar nerve cleared away from the internal condyle. The disease was found to extend the entire length of the ulna. An endeavour was at first made to disarticulate at the wrist by cutting the lower attachments of the ulna; but it was found to be much more easily accomplished by cutting the triceps and lateral ligaments, and getting into the elbow-joint. The entire ulna was now disarticulated and dissected out. An inch and a half of the ends of the humerus and radius were then removed. No vessels required to be tied. The wound was left open for three hours, when sutures were inserted, and the arm placed upon a straight splint. September 1st.—The arm was placed in a semi-bent position, and laid upon a gutta-percha splint. 5th.—The whole of the wound had healed by the first intention, and the sutures were removed. 8th.—The splint was taken away, and he could move his fingers and hand, and get his left hand to the mouth with the assistance of the right, but could not do so of his own accord. 10th.—The wound completely healed twelve days after the operation. 12th.—He continues to move the joint and use his finger; but is only just able at present to raise the forearm, showing that he is beginning to regain the power over the biceps muscle. The arm is, however, small and weak. There is every prospect of the patient having a very useful arm and hand. His general health is good, and he is out of bed and going about. No. 3636 (see Plate X, fig. 1).—On examination of the parts removed, it was found that the whole of the ulna was much enlarged, from deposition of new osseous matter, enclosing several portions of necrosed bone. The whole of the cartilages covering the ends of the bones forming the elbow-joint were absorbed, and the bones carious. Dr. Woodhouse, of the

Fig 2

Fig 1

3636

C.H Ford.



Norwich Dispensary, gave the following account of the condition of this case, dated 26th March, 1860:—"I have to-day seen your old patient, W—, and regret to say that he is quite unfit to undertake the journey to Fort Pitt; he is in a very emaciated condition, and will, I think, soon succumb to his disease—'phthisis pulmonalis.' His arm is in a satisfactory condition, inasmuch as there is a good sound cicatrix, and the limb presents a healthy aspect; there is not at present, however, much power in the arm." This must be expected in a patient dying of consumption. Died 5th July, 1860, thirty-two months after the operation.

It is not often that a case occurs where the disease is entirely confined to the ulna and bones of the elbow-joint. With regard to the operation, it was found much more easy to disarticulate from the elbow than from the lower extremity of the ulna, and care was required to avoid cutting the arteries and nerves by keeping close to the bone. It is also worthy of remark that no vessel required to be tied, although they must have been increased in size to supply the enlarged ulna. The rapidity with which the wound healed is also remarkable.

The following is a case of partial excision of the *wrist-joint*: 78th Regiment. — Corporal David Fotheringham, wounded July 12th, 1857, by a musket ball, in the right wrist-joint. The ball entered on the anterior surface, and passed directly out on the posterior. Several small pieces of bone were taken away at the time. The hand has been kept in a straight splint ever since, and he has now nearly lost the use of the fingers. The wrist-joint is much enlarged; the aperture of entrance of ball is long since healed, that of exit still remains open; diseased bone can be felt. May 10th, 1858.—Diseased bone taken away by the gouge. June 2nd.—Invalided. General anchylosis of the carpal bones. Wound nearly healed; has the use of the fingers to some extent.

Radius.

Fractured or necrosed portions of the radius, or even the whole of the bone, may be removed by incisions on the outside or posterior aspect of the forearm.

Wrist-joint.

This joint may be excised, and the ends of the radius and ulna, with portions of the carpal bone, for gunshot wounds or disease; but no definite rule can be laid down, as a good anatomist and surgeon will have no difficulty in knowing how to act in any particular case.

Fingers.

It is always necessary to take into consideration the probable after utility of the part which it is wished to save in excision of the metacarpal bones and phalanges; for after the removal of a portion of bone or finger, it may be so stiff as to be perfectly useless and very much in the way, and may ultimately require to be amputated. If the hand itself can by any possibility be saved, however multilated or stiff it may be, it will most probably be of more service than any after substitute, as even a stiff wrist and shrunken hand is better than none at all.

INFERIOR EXTREMITIES.

Excision of the Hip-joint.

Ten cases of wounds of the hip-joint are returned in the report on Crimean wounded. In 3 there had been such extensive injury inflicted that they proved fatal in a few hours; 7 were discharged for operation, 1 of which was for amputation at the hip-joint, in a case of extensive longitudinal fracture into the joint; the remaining 6 for resection of the head of the bone.

Excision of the hip-joint for gunshot injury has been performed eleven times. Of these, but one recovered, that of a soldier wounded by a shell at Sebastopol, and operated upon by Dr. O'Leary. The patient was twenty-five years of age; the head, neck, and trochanter of the femur, were removed.

Of the 11 cases recorded, 6 occurred in the Crimean war; 1 occurred in the Schleswig Holstein war; 1 by Dr. Ross, 1

by Oppenheim, 1 by M. Scutin, and 1 by Schwartz. In the Crimean war excision of the head of the femur was performed 6 times, and all but one were primary operations. One of the patients survived the operation, and recovered, viz., Private Thomas M'Kenna, 68th Regiment. On his arrival at Chatham the limb is reported to have been about two and half inches shorter than the other, and capable of bearing some considerable portion of the weight of the body. He could swing it and advance it, but the knee could not be bent. Rotation was admitted to a very limited extent, but performed with considerable pain. The wound was soundly healed, and the man was discharged from the service.

So far as the results of the Crimean war go, it clearly proves the superiority of excision of the head of the femur over amputation at the hip-joint.

The head of the femur has frequently been excised for morbus coxæ, and with great success, but no comparison can be made between it and that for gunshot wounds. No doubt in any future campaign excision of the hip-joint will be much more frequently employed, and great attention paid to the selection of cases.

When the operation is performed on account of disease of the hip-joint, it would most likely be necessary to scrape away portions of the cotyloid cavity. In gunshot injury this operation is generally the only alternative of the surgeon to save his patient from almost certain death, or the last very doubtful alternative of amputation at the joint.

The cases for this operation on account of gunshot injury should be well selected, and also those resulting from disease. In those consequent on disease, and where there is reason to apprehend abscesses in the psoas and iliacus muscles, &c., the result must be the reverse of satisfactory.

In consequence of the unfavorable condition of the lower extremity resulting after many months, where an endeavour had been made to preserve the limb, during the Crimean war, the French surgeons, during the last Italian campaign, have abandoned, as a general rule, conservative surgery in the lower extremity, except in injuries near the hip-joint, and have taken to primary amputation as the more successful practice.

Many different methods of exposing the upper part of the femur have been recommended, but a good sound knowledge of anatomy will best enable the surgeon to suit his proceeding to each particular case. One straight incision or a semilunar one will in general be sufficient.

One method, the patient being placed on his side, a deep incision with a strong bistoury should be made from above downwards over it, and on to the outer side of the femur through the skin and muscles; the fractured portion of the head or neck of the bone should be removed by the strong forceps; or if in a case of disease, the head, neck, and trochanter major, may be isolated and thoroughly turned out of the wound by twisting the limb over the opposite thigh, and a common saw applied to effect excision of the upper portion of the femur to whatever extent is required.

A *second method* is to make a semilunar incision about two or three inches above the trochanter, its ends being so limited as not to interfere with the crural nerve in front or the gluteal artery behind; from the centre of the cavity thus formed a straight line of incision should be carried downwards over the trochanter; the knife should then be carried deep, and a flap turned forwards and another backwards, so as to expose the upper portion of the trochanter; the neck of the bone, and capsular ligament, and the muscles situated close to the joint should then be freely cut and the capsule opened on its outer aspect, when, by twisting the thigh across the other and rotating it outwards at the same time, the head of the bone will start from its socket, and the round ligament cut with a knife (if not already destroyed) and the diseased parts either removed by the gouge or saw. The lever force is however wanting in gunshot fractures. If the incisions are carried too far in front or behind, great injury may be inflicted on the nerve or vessels, and both should be carefully avoided. There is little to be feared from the hæmorrhage; the only large arteries are the gluteal and its branches. The after treatment consists chiefly in quietude, the use of a splint, and water dressing.

Knee-joint.

Excision of this joint is very rarely practised in the present day for gunshot wound.

There is a great similarity between the diseases of the elbow and knee; but in the excision of the latter there is a greater relative danger on account of the larger extent of the ends of the bones to be removed. In a case where the articular surfaces of the femur and tibia are injured by a musket ball, without much laceration of the soft parts, excision may be performed in preference to amputation of the thigh, with a chance of success, provided absolute rest and good accommodation can be obtained. If sufficient data could be procured, it might be found that excision of the knee would bear a like proportion to that of the elbow as amputation in the thigh does to that in the arm, and therefore excision in the lower would not be so successful as in the upper extremity. Anchylosis of this joint after serious disease is what is most desired if the limb is in a straight position, and the same object should be the aim of the surgeon after excision, either for injury or disease of the joint.

I have seen two cases of excision of the knee-joint which had been performed by my respected teacher, Professor Fergusson, in patients who had suffered from disease of the joint, and which had become anchylosed with the knee in a bent position. Wedged-shaped portions of the articular ends of the bones were taken away and the limb straightened. Several months after the operation the patients had good useful limbs, and able to walk about for miles without the aid of a stick, the leg being only an inch, or an inch and a half shorter than the other, thus forming a much better substitute than any artificial limb.

The operation may be performed in the following manner:— On each side of the knee-joint an incision about three or four inches in length should be made on each side of the joint, opposite to the lateral ligaments, and another made across in front, so as to unite with the other and form a letter H. The ends of the soft parts should be dissected upwards and downwards and the patella detached; and then the lateral and

mainder of the foot may be saved by amputation of the affected part, and the toes removed at the same time. Should the point of the toe be saved and the part behind removed, the portion left would most probably be useless; although a very different procedure is advocated for disease of the metacarpal bone of the fingers and the thumb.

No set rules can, however, be laid down for any of these operations on the tarsus and metatarsus, and everything must depend upon the nature of the wound; and the anatomical knowledge of the surgeon can generally devise some means for the removal of the injured or diseased part, instead of the last resource of amputation.

the saw or forceps. The limb should then be turned on the outer side and the internal lateral ligament divided, taking care not to wound the posterior tibial artery. The foot should now be dislocated outwards and backwards, and the lower end protruded through the wound; the lower ends of the tibia and also of the articular surface of the astragalus are to be removed by the saw, and the cut surfaces of the tibia and astragalus kept in close approximation, and the limb placed on a splint and dressed in the usual manner.

Astragalus.

Mr. Turner, of Manchester, states that out of eighteen cases of dislocation of this bone, where complete excision of the displaced bone was performed, fourteen made good recoveries, and in one only was there anchylosis.

Os calcis.

When the disease is in the posterior, lower, or outer aspect of the bone; then either partial or complete excision may be resorted to with every prospect of success. Great freedom can be taken on the outside, while on the inner greater care must be taken to avoid the vessels and nerves.

The bone can be dissected out from behind in injury or disease. A semilunar incision down to the bone from the posterior angle of the internal malleolus should be made across the foot; this flap is to be turned back, and the tendo Achillis cut across; also the ligaments which connect the astragalus and os calcis should be divided, and all the interosseous ligaments cut across and the bone dissected out. The only vessel requiring ligature will be the posterior tibial artery.

Tarsus and Metatarsus.

In gunshot wounds of these parts the ball should be extracted and the fractured portions removed, and the wound treated according to the general principles of surgery. When it is thought that the disease is limited to one bone, the re-

mainder of the foot may be saved by amputation of the affected part, and the toes removed at the same time. Should the point of the toe be saved and the part behind removed, the portion left would most probably be useless; although a very different procedure is advocated for disease of the metacarpal bone of the fingers and the thumb.

No set rules can, however, be laid down for any of these operations on the tarsus and metatarsus, and everything must depend upon the nature of the wound; and the anatomical knowledge of the surgeon can generally devise some means for the removal of the injured or diseased part, instead of the last resource of amputation.

CHAPTER XX.

THE NUMBER THAT ARE WOUNDED, AND THE PROPORTION THAT SURVIVE UNDER THE DIFFERENT CLASSES OF GUNSHOT WOUNDS.

It is curious to remark the numbers that are wounded, and the proportion that survive under the different classes of gunshot wounds. Take, for example, the total number of cases that arrived from India under wounds of the three large cavities, up to March 31st, 1858:

Head, 15, or 2·48 per cent. of the total that arrived, viz., 603. Chest, 19, or 3·16 per cent. Abdomen, 8, or 1·15 per cent.

The numbers from India do not represent the frequency or the mortality of gunshot wounds in those different regions; but from April 1st, 1855, to the end of the Crimean war,* the total wounded was 7153. Of these, in the—

Head, 851 treated, or 11·9 per cent. of the entire wounded; 170 died, or 20 per cent. of those treated. Chest, 420 treated, or 5·8 per cent. of the entire wounded; 118 died, or 28·1 per cent. of those treated. Abdomen, 235 treated, or 3·28 per cent. of the entire wounded; 131 died, or 55·7 per cent. of those treated.

From this it would appear that gunshot wounds of the head (in siege operations, at least) are twice as frequent as those of the chest, and more than three times compared to the abdomen; while wounds of the chest are more than 8 per cent. more fatal than the same injury in the head, and gunshot wounds of the abdomen are 27 per cent. more fatal compared to those of the chest.

* *Vide* Report.

On comparing the frequency among the cases from India of—

Gunshot wounds of the superior extremity, 159, or 26·36 per cent. of the total that arrived. Amputation of the superior extremity, 127, or 21·22 per cent. Total, 286, or 47·42 per cent.

Gunshot wounds of inferior extremity, 162, or 27·03 per cent. Amputation of the inferior extremity, 34, or 5·80 per cent. Total, 196, or 30·84 per cent.

From this it is seen that there is only an excess of 3 in the wounds of the lower than that of the upper extremity; but the proportion of successful amputations is very much in favour of the superior extremity, there being 83 more than in the lower extremity. The number of amputations of the arm are 46, and of the thigh 11. This difference is to be attributed to the greater mortality in amputation of the thigh over that in the arm. The amputations of the forearm and leg are very nearly the same, being 19 of the former and 18 of the latter. There are 53 amputations of the fingers and thumbs, while there are only 2 of the toes; still, these minor operations raise the proportion of the total number of successful amputations of the superior over the inferior extremity.

In the Crimean war there were—

Gunshot wounds of the superior extremity, 2083 treated, or 30·2 per cent. of the entire wounded; 47 died, or 2·9 per cent. of those treated. Gunshot wounds of the lower extremity, 2198 treated, or 31·76 per cent. of the entire wounded; 166 died, or 8·3 per cent. of those treated.

Had the result of the operations performed been added, the difference would have been increased in a very material degree.

The number of cases that occurred under the remainder of the classes is very small, as the following extract from the return of the India cases will show:

Gunshot wounds of the face, 22, or 3·64 per cent. of the entire wounded.

Ditto, neck, 7, or 1·15 per cent.

Ditto, back and spine, 9, or 1·49 per cent.

Ditto, perinæum, genital and urinary organs, 3, or 0·49 per cent.

Ditto, with direct penetration of the larger joints, 8, or 1·32 per cent.

Ditto, with direct injury of the large arteries, not being at the same time cases of compound fracture, 0.

Ditto, with direct injury of the larger nerves, not being at the same time cases of compound fracture, 6, or 0·99 per cent.

Sword and lance wounds, 12, or 1·99 per cent.

Bayonet wounds, 2, or 0·33 per cent.

Miscellaneous injuries received in action, 9, or 1·49 per cent.

On referring to the "Return of the Wounded from the Crimean War," nearly the same proportion under these classes is found to hold good:

Gunshot wounds of the face, 533 treated, or 7·45 per cent. of the entire wounded; 14 died, or 2·60 per cent. of those treated.

Neck, 128 treated, or 1·79 per cent. of the entire wounded; 4 died, or 3·12 per cent. of those treated.

Back and spine, 326 treated, or 4·55 per cent. of the entire wounded; 45 died, or 13·49 per cent. of those treated.

Perineum, genital and urinary organs, 55 treated, or 0·76 per cent. of the entire wounded; 17 died, or 30·96 per cent. of those treated.

With direct penetration or perforation of the larger joints, 121 treated, or 1·65 per cent. of the entire wounded; 25 died, or 20·66 per cent. of those treated.

With direct injury of the larger arteries, 12 treated, or 0·16 per cent. of the total wounded; 8 died, or 66·66 per cent. of those treated.

With direct injury of the larger nerves, 22 treated, or 0·30 per cent. of the total wounded; 8 died, or 36·36 per cent. of those treated.

Sword and lance wounds, 7 treated, or 0·09 per cent. of the total wounded; 1 died, or 14·28 per cent. of those treated.

Bayonet wounds, 36 treated, or 0·50 per cent. of the total wounded; 4 died, or 11·11 per cent. of those treated.

Miscellaneous wounds received in action, 126 treated, or 1·62 per cent. of the total wounded; 6 died, or 4·76 per cent. of those treated.

CHAPTER XXI.

TRANSPORTATION OF SICK AND WOUNDED.

This is a subject demanding the attention of every military surgeon; although not exclusively of a professional nature, still it ought to be one of his special care. It is a matter of the greatest importance during an action, and is one of the chief difficulties in the operations of all armies, not only affecting the wounded themselves, but also the whole army. Numbers of men fall out under the pretence of attending to a wounded comrade or officer, when they ought to remain in the ranks doing their duty.

There is now an Army Hospital Corps, to attend upon the sick and wounded in field and general hospitals, &c.

The Military Train has in charge a fixed amount of the wheel and other means of transport, which now ought to do away with the colouring pretext under which some men formerly left the field during action.

It appears to me that it would be of advantage to have an *Ambulance Corps*, and a certain number of men, under a *permanent military officer*, belonging to the *Military Train*, and *appointed specially* for this *particular duty*, so that he might be held *responsible* for the *proper equipment* of *every description* of *conveyance for the sick and wounded under all circumstances.*

The horses used for ordinary purposes in the waggons of the Military Train will not remain quiet under *litières* and *cacalets*; and further, the horses for conveyances of this description should be *trained daily* to carry some such load; as not one horse in a hundred, in anything like good condition, would carry a *litière* swinging on its back. Still, it may be remarked that horses during a campaign are not generally so very fresh as in the time of peace.

Mules, however, are very much better adapted for the conveyance of sick or wounded on their backs than *horses*.

Under the head of "Regulation for Field Hospitals," contained in the last Army 'Medical Regulations,' published in 1859, page 69, *every particular of the amount* and *different description* of *wheels* and *other conveyances*, *&c. &c.*, allowed in time of war for each battalion, brigade, and division, will be found.

I. Conveyance carried by Men.

Doolies and palanquins are means almost universally in use in the Indian Army, and cannot be done without, not only during the time of peace, but also in war, and it cannot be surpassed by any other in a country where bearers can be procured; and the only way to secure the services of these bearers is to give them the same pay as that given to the fighting portion of the army.

The form of doolies somewhat varies in the different presidencies; sometimes it consists only of a cot suspended by a bamboo and screened by an awning from the sun; but the following description of dooly and bearer, as seen in the accompanying plate, is that of the one which is found most serviceable, and is in general use in almost all hospitals, &c., in India. Although a more expensive one, under the name of a palanquin, is used by officers and those who can afford to pay for them, still they are in no respect better for the conveyance and treatment of sick than the common dooly.

In an Indian campaign, where there are perhaps 500 doolies, with the proportionate number of dooly-bearers, which makes such a large body of untrained followers as to be unwieldly and encumbers military movements by the space they occupy with the doolies on the march. In India wheeled carriages might be substituted in many cases for a portion of the doolies, as generally about one half of the sick and wounded are capable of being moved by the wheeled conveyance; but the old Indian hackery is very unfit for the purposes of war, and in place of them long carriages, on springs, capable of holding eight or ten convalescents in a sitting position, should be substituted.

A good dooly establishment is, under all circumstances,

however, the greatest comfort that can be attached to an army in India. Suppose the arrangements are for 500 sick and wounded, 300 doolies should be attached to a field hospital, and more could be obtained when required; and with the addition of twenty good four-bullock covered hackeries for the conveyance of the slighter cases of sick and wounded, the whole can be easily carried on the line of march.

Dooly-bearers.—For 300 doolies the following establishment of bearers is required:

1 chowdry and native writer (of English) in one person.

18 sirdar bearers.

36 mate bearers.

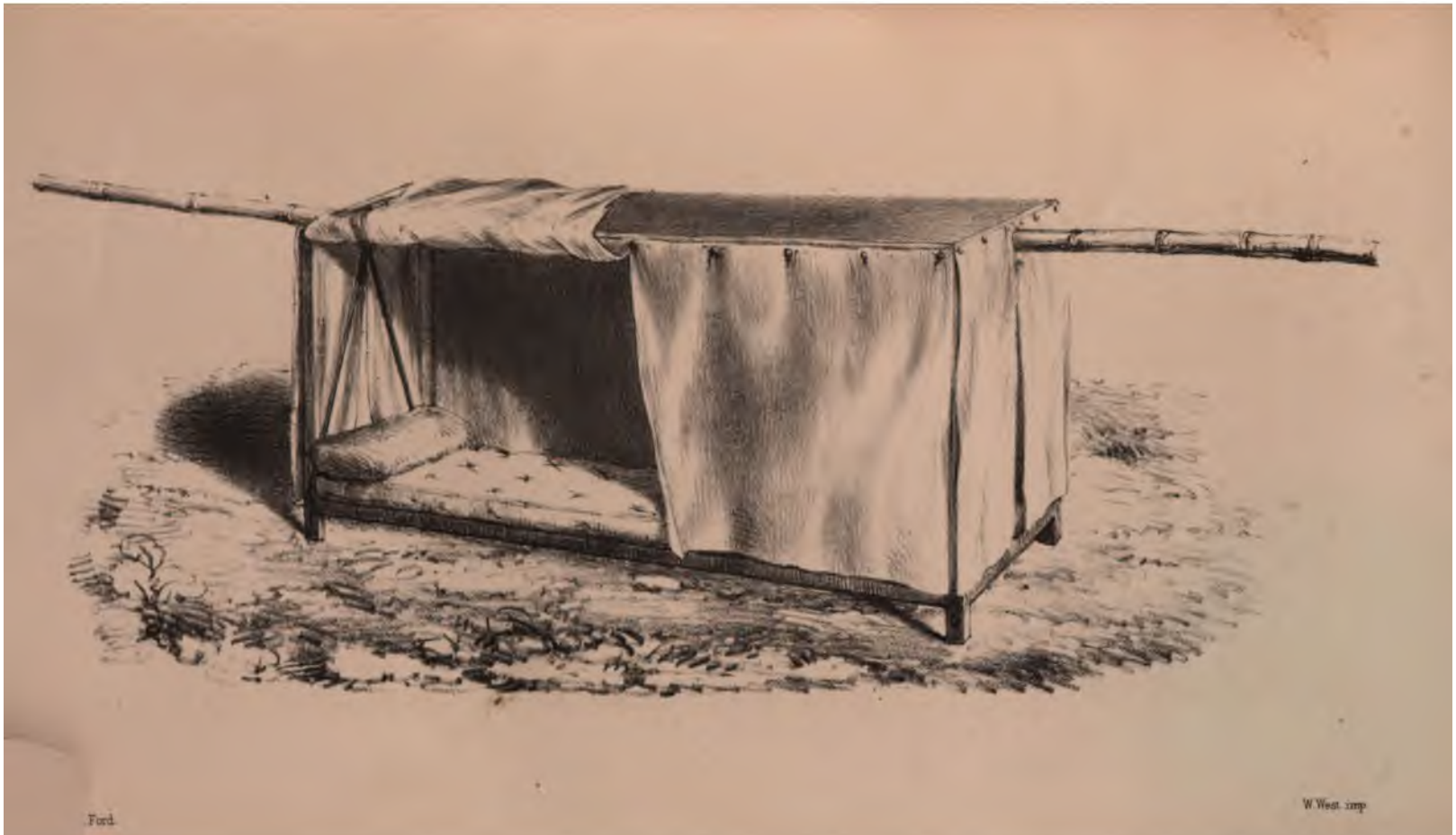
1800 bearers, that is, 6 to each dooly.

The only men that are to be depended upon are those from Bengal, Bareilly, Oude, or Cawnpore; those from the Punjaub are quite unaccustomed to carry our description of dooly, and are also totally untrustworthy, and are certain to desert at the time they are most required.

On the line of march the doolies ought to be kept well together, otherwise the bearers, instead of attending to their duty, straggle all over the country in quest of plunder, firewood, &c. When they receive only four rupees a month, with one rupee extra in the field, they are certain to desert when their duties become in any way arduous or dangerous, or when the price of provisions become high, as it usually does on a distant campaign; but when seven or eight rupees per month is given, their services may be depended upon under all circumstances, and there need be no fear of their ever deserting.

The bearers are usually collected in parties or goles from different districts, and generally join the army in the goles or companies; each gole should, if possible, consist of 1 sirdar, 2 mates, and 96 bearers, with 16 doolies, all numbered and registered; and each gole ought to be held responsible for the doolies thus made over to them.

Plate XI represents the description of dooly which is used for the conveyance of the sick and wounded in India. The dooly forms in the field the patient's bed, as well as means of conveyance from the time of his being wounded until he is either cured or the case terminates fatally. There are two



Ford.

W.West. imp

dooly-bearers in front and two behind, with the reliefs; they generally carry the dooly from ten to fourteen miles' march a day. When they arrive at the encampment, they run the dooly into the hospital tent, take out the pole with the tarpaulin covering and curtains, and then leave the patients comfortably in their beds; the following morning, at a certain hour, the bearers return with their bamboo pole and the top of the dooly, put them on in a minute, and start for the next halting-place. The roofs of two doolies placed together form a shade for the bearers at night, and during the heat of the day. During the Crimean war Deputy-Inspector J. R. Taylor, C.B., who has had great experience in India, and also in Europe, recommended a dooly corps. Sir George Ballingall, in his 'Military Surgery,' fourth edition, page 106, says—"Nothing can well be conceived more perfectly adapted to the conveyance of sick than the dooly;" and I shall only further quote the words of an Indian medical officer, Superintending-Surgeon Charles Renny, in his 'Report on the Medical Arrangements of the Army of the Punjaub during the Campaign of 1848-9:'—"The dooly is the most comfortable conveyance for a wounded or sick person; it cannot be replaced by anything better." Inspector-General Muir, C.B., also remarks in his 'Report on the last Campaign in China:'—"that there is no kind of sick transport equal to a dooly, and that the dooly made use of in the past campaign is still capable of improvement. An improved dooly has since been designed, which it is hoped will meet every requirement when human labour is made use of." And this seems to be the opinion both of medical officers and also of military officers who have served in India, and are, therefore, qualified to judge.

It would be too expensive, and perhaps an unnecessary measure, to have, as in India, one dooly and dooly-bearers for each regiment, or even for battalions at home in time of peace; still, a suitable supply of doolies might be procured from India, and placed in store until required in the event of war, when bearers could be immediately called for from India for this duty.

The best dooly-bearers generally come from the country round Cawnpore and the lower provinces, and, though natives

of such a hot country, are surely as able to serve in the capacity of bearer in a European climate as the British soldier is able to serve as such in the Bengal climate. There should be eight bearers to each dooly, with the usual number of sirdars, mate-bearers, and mussalchees; they should be enlisted, have extra pay for foreign service, and be entitled to a pension on being sent back to India, disabled by disease or injury.

Stretchers, which roll up with a covered pall, and of the ordinary canvas pattern, are best, but they should always have a movable transverse bar of iron to keep the poles separate, else the weight of the patient sinks down the canvas so as nearly to touch the ground, and the poles close in upon the bearers so that it is almost impossible for them to move.

II. Conveyance on the Back of Animals—Horses, Mules, Elephants, Camels, &c.

Litières.—This is a means of conveyance for a sick or wounded soldier, extended at full length, one on each side of a horse or mule. They have certain disadvantages. It is very difficult for a man in perfect health to get up into them; and it would require at least three, if not four men, to lift a wounded comrade, and the horse at the same time perhaps restive. Having placed the patient in it, this side sways down and makes it more difficult to get the second man into the other, and without two to adjust the weight the horse could not carry its load with any comfort to the wounded; and further, it takes away (in some cases) four men to help one wounded comrade, in a not over-pleasant conveyance, when they ought to be in the ranks. Still, in many cases on service there is no doubt that they have been found of great service; the French used them in the Crimea with advantage, and during the last war in China Inspector-General Muir, C.B., Principal Medical Officer of the Expeditionary Army, states that the litières and cacalets did excellent service, and this is from an officer of very great experience in these matters.

Cacalets are a means of conveyance for sick or wounded men in a sitting position, one on each side of a horse or mule, &c. The same remarks are applicable to cacalets as to litières.

Elephants.—To every hospital in India there are a certain number of elephants attached, for the conveyance of convalescents, sick, or men with slight ailments, and they are very pleasant, easy, and excellent means of transport.

Camels are usually employed only as beasts of burden, as from their peculiar gait their pace is not well adapted for wounded men. Indeed, I have known a soldier (a noted malingerer) placed upon a camel as a punishment when he refused to march, and not being accustomed to the motion, he soon begged to be allowed to get down and to take his place in the ranks.

In a hilly country, such as the Punjaub, it has been recommended by C. Renny, Esq., late Superintending Surgeon, Army of the Punjaub, that kajawahs, carried on camels, would be the proper conveyance for the sick—that is, as extra carriage beyond a full provision of doolies, not that the former can be compared with the latter, but from the necessity of the case. These kajawahs are made so as to hold with ease two men, one on each side, stretched at full length, affording such ease as this kind of conveyance can give. A train of (in India) 100 or 200 camels, provided with such kajawahs, would render a large army independent of the impediments of great casualties in the field.

Four bullock hackeries, covered, are, however, better than these, and carrying only five men each, and with good bullocks, they can easily keep up with the movements of the army.

III. Wheel Carriages, or those drawn by Horses, Mules, Bullocks, &c.

Baron Percy describes an ambulance, with four wheels, of a very simple construction, and Baron Larey invented two spring waggons, one with two, and another with four wheels. Dr. Millangen proposed a long carriage, resembling an Irish jaunting-car, to be drawn by two horses, capable of containing twelve men, seated back to back, for those wounded in the upper part of the body,—without fracture of the lower extremity. Mr. Cherry proposed a light single-horse cart, so constructed as to be readily adapted either for the conveyance of wounded men or for the carriage of stores or provisions.

In our army at the present time the wheel conveyances now in general use are spring waggons and carts.

Ambulances.—Those now in use are covered waggons, on springs, fitted up so as to accommodate eight men, two in a recumbent position and three sitting up in the front and three behind, *vide* 'Army Medical Report,' p. 69, published in 1859. Ambulances are an admirable means of conveyance for sick and wounded. Still, they are capable of improvement in some *minor details*.

In some cases the ordinary baggage waggon might be used or adapted for the purpose of ambulances, when required. In the Peninsular war it was by carts that the greater proportion of sick and wounded were carried to the hospitals in the rear, and few were carried on the backs of mules.

IV.—Hospital Transport:—Hospital Steamships "Mauritius" and "Melbourne," equipped for service in China.

A brief description of the general arrangements for the accommodation of the sick provided in each ship may be seen in the 'Statistical and Sanitary Reports of the Army Medical Department for the year 1859,' page 337.

These two ships were fitted up under the immediate superintendence, and everything done at the recommendation or suggestion, of the Director-General and the officers attached to the Medical Board; and from what I have seen of them myself, and heard from those who have served on board of them, they are constructed on the best and most approved plan that can be devised in the present day for the comfort and convenience of sick and wounded on board ship. These two ships were fitted up expressly for the last war in China in 1860.

W. M. Muir, M.D., C.B., Inspector-General and Principal Medical Officer of the Expeditionary Army during the last war in China, in his report (*vide* 'Statistical, Sanitary, and Medical Reports of the Army Medical Department for 1860,' page 375, who is an officer of great experience, remarks—"the unspeakable advantages to an army in active service of being attended by hospital-ships of the size and equipment of the "Mauritius"

and "Melbourne." That sailing ships are the best suited for the purpose of stationary hospital-ships, and that wooden are preferable to iron ones. I presume that in any future wars such vessels will be considered a part of the necessary equipment, and it is much to be regretted that they are not upon a permanent footing, and used in time of peace for the transport of invalids from foreign stations. They should form a constituent part of the hospital equipment of our army, have a staff of medical officers, and be directed and formed in all respects as a general hospital on shore. Wooden ships in tow of steamers are preferable to steamers themselves as floating hospitals; the engines and its appendages take up too much space, and do not admit of sick-decks being, as they ought to be, from stem to stern. Moreover, in tropical climates, wooden are found to be much cooler than iron ships."

Although not at all in any way connected with the subject of transport of sick and wounded, except that these two hospital-steamships "Mauritius" and "Melbourne" were ordered to convey the sick in the late war in China to the Cape of Good Hope, where there was a sanitarium, instead of sending them direct to England; Dr. Muir's remarks appear to me so worthy of notice, that I take this opportunity of transcribing them, although much out of place in this part of the work:

"A sanitarium was established at the Cape of Good Hope chiefly for this expedition, and steam-vessels, if necessary, were ordered to be chartered for the more speedy conveyance of invalids thither. It may be questioned, however, whether a true sanitarium can exist anywhere out of England. Man is a complex being, and in sickness the mind must be ministered to as well as the body."

"Tell a patient, worn down by exhausting disease or tropical heat, that he will be sent next week to the cool and healthy climate of the Cape, and he will turn on his pillow with indifference; but tell him that he is to go home, and the magic sound of the word '*home*,' even if he has not a near relative in the world, will make him quiver with joy."

Having been ordered to the Cape of Good Hope along with Mr. Taylor, C.B. & I.G., and placed by him in charge of the Sanitarium for Invalids from China and India in 1860,

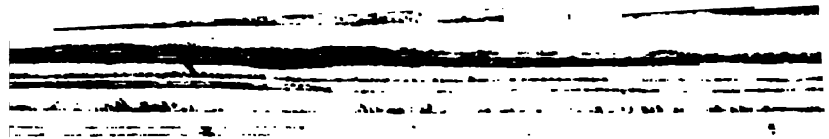
and from my experience there I can only say that I entirely agree with W. M. Muir, M.D. & C.B., & I.G., viz., that all sanitarium, at the Cape or elsewhere will never be of advantage to the army—I mean those half-way places between India and China. Australia has also been proposed as a sanitarium; but however good the climate may be, it appears to me that such a scheme would never be of the slightest good to sick or wounded soldiers from any of our colonies. I do not, however, allude to the hill stations in India as sanitariums and others of our colonies, which are generally of very great advantage. At the Cape I found it almost impossible to keep the really sick in good spirits and contentment, even when they had every comfort, accommodation, and a good climate for the cure of disease; also, that the convalescents out of hospital were very irregular, and caused great trouble to the commanding officer. According to my experience, when an officer or soldier is really sick on foreign service, send him *home at once*, and not to an *intermediate sanitarium*; for the best sanitarium is *home*. *England* is a grand word for a sick soldier on foreign service. It is also well known that when soldiers of different regiments are brought together into one depôt, they are much more difficult to keep in good order than the same number of men belonging to one regiment, because they are without comrades, and there is a want of *esprit de corps*, &c.; and some take to drinking, and consequently disease is the result.

V. New Railway Hospital-carriage.

In a paper on the hospital arrangements at the Camp of Chalons, published in the 'Récueil de Mémoires de Médecine Militaire' for 1859, M. Jules Périer, Médecin-en-chef, gives the following description of an hospital-carriage, fitted up for the conveyance of the sick by the railway from the camp to Chalons, in the hospital of which town the more serious cases occurring in the force were treated (*vide* 'Statistical and Sanitary Report of the Army Medical Department for the year 1859,' page 340). M. J. Périer states that a "baggage waggon could, without difficulty, be fitted up for the accommodation of patients,

either sitting or lying down, as the nature of their cases might require, and in which they might be attended to, and, if need be, receive medical aid. I shall now describe the hospital-carriage in which our sick were conveyed:—The interior of an ordinary baggage waggon is open on each side by two sliding doors; in front of the waggon is placed the breaksman's seat; it can, however, be made available for the accommodation of two sick lying, and likewise provide seats for one or two attendants. In the space remaining unoccupied five movable benches were arranged. These arrangements afforded room for 25 sick sitting and 2 lying on mattresses, placed on each side of the stage of the breaksman's seat already mentioned."

"*Bed-litters.*—The ordinary litters of the hospital could not have been made use of without encumbering the carriage, the width of which is seven and a half feet, which is less than the entire length of the ordinary litters; six bed-litters, therefore, with movable sides, were constructed. Of these, two for each division were kept in the field hospitals of the camp, and were at all times available for the conveyance of the sick of the different corps who were not in a fit state to be placed in an ambulance waggon. On field days one of them was always placed behind each of the hospital store waggons which followed the movements of the force. Thus, either in camp, beside the tents, or at the field hospital, or on the ground where the evolutions were taking place, a patient might be placed on the bed-litter, from which he would not require to be again removed until his arrival in the wards of the hospital at Chalons. The bed-litters have been of real service to us, not only on account of the ease with which they can be placed and arranged in the hospital-carriage, but as substitutes for beds, their excellent construction allowing them to be used as such for patients whom it would be unsafe to move. We would here remark that no conveyance, for either sick or wounded, can, for safety or convenience, in our opinion, equal the litter. To appreciate those cases in which its employment is indispensable, and to see that it is provided for the conveyance of such, are important points in the duty of a regimental surgeon, who ought never to dispense with its use simply on account of the number of bearers it requires."



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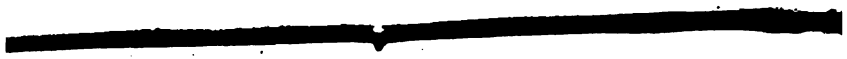

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